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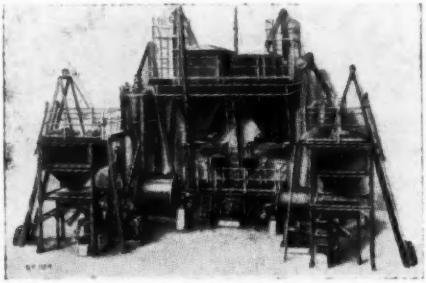

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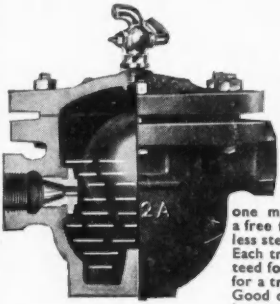

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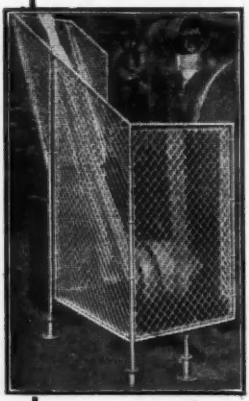

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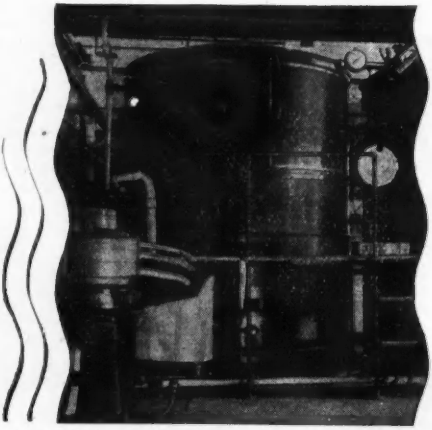

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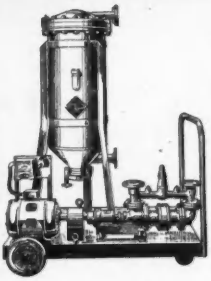

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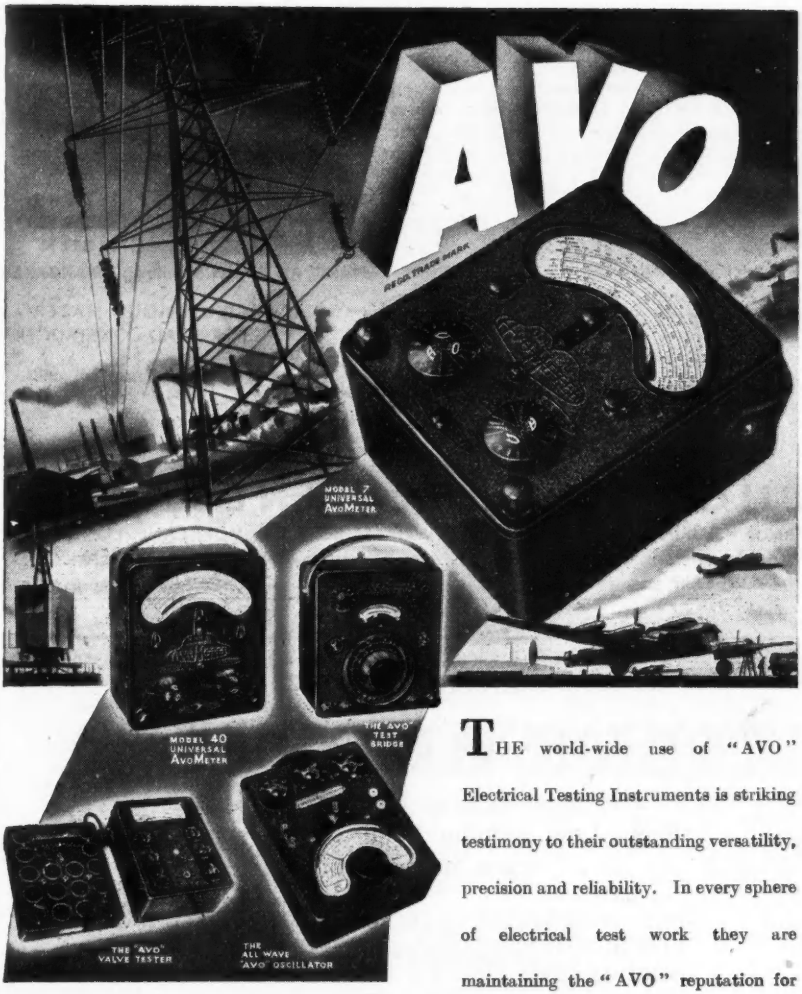

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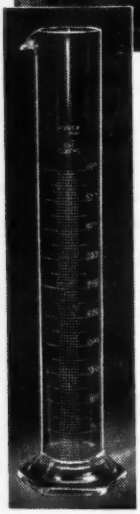

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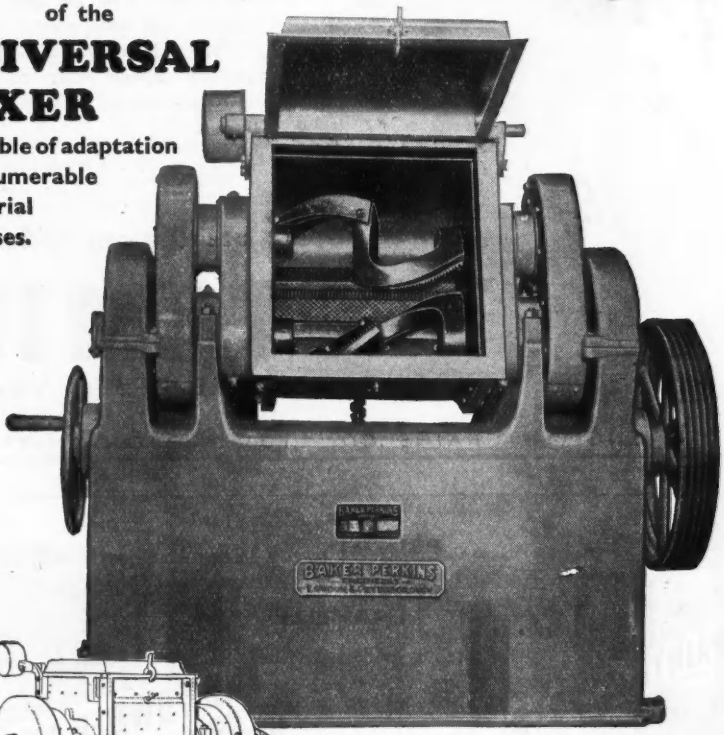

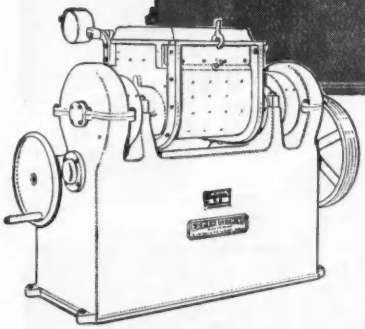

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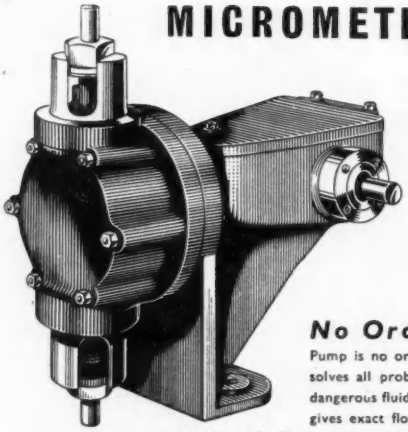

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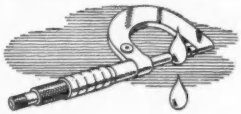

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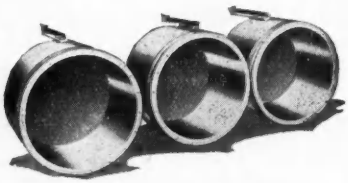

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A Crisis in British History

" She left the web, she left the loom,
She made three paces through the room,
She saw the water-lily bloom,
She saw the helmet and the plume,
She look'd down to Camelot.
Out flew the web and floated wide;
The mirror cracked from side to side;
'The curse is come upon me,' cried
The Lady of Shalott."

TENNYSON has lately come back into fashion and there must be many of our readers who remember the sad fate of the Lady of Shalott. Shut in her room, she watched through a mirror the procession of knights and commoners, of country-folk and boatmen, the whole pagentry of life, pass her window. She took no part in life, her's was a purely theoretical interest with which she could sit at the ringside, as it were, to criticise and comment. One day temptation to take a hand in the practical affairs of life proved too strong; she looked through her window down to the great city; she adventured into the stream of life; and disaster followed.

There is a great deal in the story of the Lady of Shalott that matches the events of the last two years. Blessed by strong leadership and faith in our cause, aided later in the struggle by the most powerful nations of the world, we came through the second great war in our history militarily victorious. We sat on the top of the world. The war, however, bequeathed great problems that needed for their solution great leadership. Unfortunately it was at this moment that the nation decided to place its destinies into the hands of the modern ladies of Shalott, theoretical critics of world politics without practical experience of the handling of affairs. Energies that should from the start have been devoted to securing national unity, to making ready for the economic crisis that everyone with any knowledge of affairs must have foreseen, were expended upon putting into action socialist theories. More than half the voters of the country expressed themselves against such a policy, but, once in power, the Government made haste to put their theories into practical effect as fast as they could. Parliament was overworked, the Civil Service was overworked, everyone who could contribute useful ideas was overworked so that there was no time to think—and all this effort was to deal with measures which could not contribute in the smallest degree towards our economic rehabilitation. Instead of unity there has been veiled class warfare. Instead of skilled planning there has been nationalisation, which is nothing more than a change of ownership in certain industries. Private enterprise has been stifled. Government control has cast its dead hand upon everyone. Now the curse has come upon us.

Unlike the Lady of Shalott we cannot lie down and die. We propose to live. It is the duty of the Government of the day to devise measures to meet the national crisis that has resulted as the after-effects of expending our treasure in the defence of mankind against a mighty despotism. In 1946 we had an adverse balance of £400 million; by the first half of this year that had risen to the annual rate of over £700 million. That balance was foreseen and the American loan—which we shall presently have to repay—was negotiated to give us a breathing space (that space which has been wasted in putting socialist theories into effect), but due to world rise

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in prices, the loan will be exhausted long before the estimated period. We appear to have about six months to put our house in order and to find means either by cutting imports or by increasing exports (in practice by both) to convert the £700,000,000 deficit into a balanced budget, or a profit. Had we started to do this two years ago we might have got a long way towards achieving our objective; at least it might have been in sight. There is a great deal of sound common-sense in the criticism that whatever is done now would have been better if it had been done when the Government first came into power.

This is not a time to spend our energies in apportioning blame except insofar as the apportionment of blame enables us to see what to avoid in the future. The Government has set forth the heads of a plan, but has put before the nation no plan. They have told us what must be done in the way of increased production, decreased expenditure and so forth, but have given nothing more than the heads of a policy, admitting that the details have still to be worked out. Production for export is a case in point. We are bidden to increase exports by 160 per cent of the 1938 figure by the end of 1948. If it is a matter only of producing the goods and sending them overseas, no doubt it can be done; we can do that by working harder, increasing the machinery at our disposal to increase production per man-hour, and foregoing goods ourselves in order to send them abroad. If this were all that is necessary we would cheerfully reduce our standard of living to balance our budget; we would change our name from John Bull to John Spartan Bull. But is there any justification for the view that the world will buy that amount of goods from us? Many other countries will by December, 1948 be in the same boat as ourselves. One of the measures proposed is that we should buy less from abroad. Will not every other nation that gets into financial difficulties take exactly that same view? Are the goods that we can produce under austerity conditions likely to meet with approval abroad? If so, why do foreign nations all seek for dollars which they can spend in the U.S.A. rather than for sterling which we would accept for our goods?

The basis of our production is coal. The miners have been given everything they asked for; no doubt some other workers will have taken note of their technique. The result is that already the Government and the unions and the Coal Board have confessed by implication that all the smoothly optimistic estimates that as much or more coal would be got in five days as in six have been proved wrong by practical test. Coal has been mishandled to at least as great an extent as our other affairs. Shall we even now get enough coal for next winter's cold weather and to permit maximum production? The talk is rather of rationing coal and power to industry to keep only the essential firms in production.

The insistence on increased agricultural production is admirable. The chemical industry will have a part to play here in the provision of artificial feeding stuffs and

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NOTES AND COMMENTS

Voice in the Wilderness

BECAUSE the onlooker sees most of the game there seem to be good grounds for according more respectful attention than the average after dinner speech deserves to the apparently prophetical observations made by the principal guest of the Society of Chemical Industry at its recent dinner in London, the Master of Balliol. Lord Lindsay of Birker would no doubt disclaim the rôle of prophet as emphatically as he rejected any pretension to be regarded as a scientist; but when conjecture about the probable course of future events has logic on its side no claim to clairvoyance is involved. As an unscientific onlooker, trained, however, to estimate with more than common acumen probable trends in human affairs, the Master of Balliol has said in effect that chemists and constructive scientists at large cannot any longer logically evade responsibility for the application of results of contemporary work in the laboratories. Latterly, chemists and physicists have dispensed powers for good or evil greater even than the dictators have wielded; and of the effects of power divorced from responsibility the world has recently had some fearful illustrations. In pre-war Germany a group of powerful industrialists were doing something of the same kind, without such altruistic motives and on an infinitely smaller scale. Hitler and carnage were the result. To-day, as the Master of Balliol pointed out, chemists "could, if they put their minds to it, produce even filthier things than the atom bomb." His fear is that in the fever of some fresh nationalistic convulsion they may be coerced into doing just that, and, recollecting some of the ghastly evidence of perverted science revealed by the Nazi war trials, his fear cannot be lightly dismissed. In the recent evidence provided in London of the readiness to collaborate for scientific ends on the part of free scientists of most nations the Master of Balliol sees the seeds of an international brotherhood of enlightened men against whose concerted will even our terrestrial powers of darkness could not prevail. The readiness of most foreign scientists to promote that end is evident. If they were given the leadership of British and American scientists Lord Lindsay's would not be a voice crying in the wilderness.

Trade Union Policy

"RESTRICTIVE practices" is a term with which Government speakers have made us tolerably familiar of late. Its meaning, unless specifically qualified, is generally a capitalist conspiracy to maintain prices. Latterly events have repeatedly conspired to present the term in another context, of which a flagrant but not isolated example is that of Mr. Thomas Poole, a welder in the Austin Motor Company's Longbridge Works—who doubtless has a much more pungent word for the predicament in which he was placed by his trade union. The Birmingham and Midlands Sheet Metal Workers' Society, through its shop stewards committee, it is reported, has "fined" him 18s.: the bonus due to him for having welded more motor wings than the quota fixed by his union permitted. There were, it seems, extenuating circumstances in that Poole's transgression was committeed to ease a production difficulty on the eve of the Easter holiday. But, like the laws of the Medes and Persians, this trade union's regulations apparently take no heed of special circumstances; and Mr. Poole has aggravated his offence by saying he regarded the 18s. as "money he had earned and was entitled to keep." The president of the Metal Workers' Society simply observes that the fixing of a target figure in consultation with factory managements "improves production by giving workers an incentive to reach that output." Mr. Poole, it is evident, was guilty of an immoderate response and overreached it, and for that he was, it is reported, suspended from his union's sickness and unemployment benefit. (The union has since denied that he is to be suspended.) We have recounted this simple and presumably routine occurrence in the hope that someone will point out an extenuating factor showing that this and similar policy need not make nonsense of the current industrial programme. The union's explanation—that this welder had refused to let another man share the work he could do very well by himself—serves only to make the situation the more grotesque.

The Long View

FEW more revealing indications of the Government's capacity for taking the long view of fundamental needs of indus-

try, in addition to the present publicised shortages of coal, steel and labour, are likely to be found than its ultimate response to the two explicit warnings it has lately received from experts on the need for great expansion of the country's training facilities —academic and technological. It is essentially the concern of the Government, although the Ministries of Education and Works are the immediate authorities, because large provision of national resources of cash and building labour and materials are involved. If these are not provided in ample quantities all talk of raising the total of the country's qualified scientists to 90,000 by 1955—the minimum mentioned by the Barlow Committee—must be regarded as wishful thinking. The latest reminder has come from an authoritative deputation from the Parliamentary and Scientific Committee (including Dr. A. V. Hill, Professors Alexander Findlay, E. N. da C. Andrade, F. G. Garner and Mr. C. S. Garland), who last week told the Minister of Works that the highest building priorities as well as financial support must be gives at once if the universities were to double their output, as they must do, in the next few years. Such a building programme may cost £100 million and should be worth every penny of it, particularly, as the deputation pointed out, in the light of present economic difficulties. It remains now to be seen whether the Minister's assurance that his Ministry and the Government will co-operate fully in this urgent project is fulfilled by Government policy and whether an equally far-sighted programme is applied to the senior technical colleges, the subject of an expert report summarised in this issue. The debt which all our industries already owe to research scientists and to the technologists can never be expressed in adequate terms; given the scope and facilities, their contribution to our future economy will be worth more than a dozen dollar loans, without being expendible. No Government which fails to recognise that can hope to lead a permanent rehabitation of our national fortunes.

A CRISIS IN BRITISH INDUSTRY

(*Continued from page* 212)

fertilisers. Can the land permanently produce 20 per cent more than our best wartime efforts drew from it? Will that rate of production cause loss of fertility? Those are questions that remain to be answered; there is no evidence that any answer has been provided. Will the necessary additional 100,000 land workers be available? Land workers, colliery workers, engineering workers all require training; it is little use " directing " men and women into industries in which they are not skilled, except to do routine mass-production work. British goods will not sell throughout the world on the basis of mass-production; the world wants skilled craftsmanship from us.

But, as if to emphasise the complete lack of any thought-out plan, the Government through its new " Supplies and Services " Bill has taken the widest, dictatorial powers over the lives of every individual in the country. Yet at the same time, the Government spokesman has stated that although asking for these enormous, frightening, powers, they had no idea at all how they would be used. Even that great Labour organ, *The Times*, has been constrained to comment that while no one will suspect the Government of attempting to carry out a social revolution under the guise of emergency measures for defence, " the powers nevertheless, are totalitarian " and there should be a clear definition of the reason why they are wanted. As it is, they give to the Government " the almost unlimited conscription of persons and property." One of the alleged purposes of these powers is "generally for ensuring that the whole resources of the community are available for use, and are used, in a manner best calculated to serve the interests of the community." It is difficult to find any political or economic project which could not be brought under this clause, including temporary or permanent confiscation of businesses on the pretext that they are inefficiently managed. The measures taken to meet the present crisis are insufficient, theoretical, hazy, and the powers that accompany them are so wide as to prompt the fear that our last state may be worse than our first unless there are among our rulers those who possess altogether unsuspected sagacity in the management of business affairs.

Sulphuric Acid Statistics

Increased Use in April-June

PRODUCTION and use of sulphuric acid and oleum in the U.K. in the second quarter of this year are the subject of a summary just issued by the National Sulphuric Acid Association, Ltd., which shows a fairly substantial rise in the use of acid, but no marked increase in production. The only significant improvement in production was in contact-produced acid; which totalled 176,295 tons of 100 per cent H_2SO_4, against 149,779 tons in the January-March quarter. Total use accounted for 355,423 tons, compared with 320,897 tons in the first quarter.

SULPHURIC ACID AND OLEUM

	Chamber only	Contact only	Chamber and Contact
	Tons of 100 per cent H_2SO_4		
Stock April 1, 1947	39,713	33,036	72,749
Production ...	170,710	176,295	347,005
Receipts	36,545	35,303	71,848
Oleum feed ...	—	2,514	2,514
Adjustments ...	−45	+153	+108
Use	104,505	71,382	175,887
Despatches... ...	106,202	143,827	250,029
Stock June 30, 1947	36,216	32,092	68,308
Total capacity represented	221,890	205,700	427,590
Percentage production	76.9%	85.7%	81.2%

RAW MATERIALS

	Pyrites tons	Spent Oxide tons	Sulphur & H_2S tons	Zinc Concentrates tons
Stock April 1, 1947	73,639	143,660	54,393	33,819
Receipts	82,162	53,861	54,134	30,850
Adjustments ...	+162	+475	−254	—
Use	71,291	44,307	55,581	44,094
Despatches... ...	374	3,746	129	9
Stock June 30, 1947	84,285	149,812	52,563	20,566

SULPHURIC ACID AND OLEUM CONSUMPTION

	Tons 100 per cent H_2SO_4
Accumulators	2,165
Agricultural purposes	702
Bichromate and chromic acid	1,783
Borax and boracic acid	
Bromine	2,674
Chlorsulphonic acid	
Clays (Fuller's earth, etc.)	1,478
Copper pickling	640
Dealers	4,283
Drugs and fine chemicals	2,077
Dyestuffs and intermediates	15,670
Explosives	3,235
Export	1,358
Formic acid	
Glue, gelatine and size	100
Hydrochloric acid	13,718
Hydrofluoric acid	955
Iron Pickling (including tin plate)	20,390
Leather	1,208
Metal extraction	321
Oil (mineral) refining	8,709
Oil (vegetable) refining	1,660
Oxalic, tartaric and citric acids	2,078
Paint and lithopone	12,957
Paper, etc.	767
Phosphates (industrial)	1,165
Plastics, not otherwise classified	4,396
Rare earths	2,211
Rayon and transparent paper	32,779
Sewage	2,531
Soap and glycerine	684
Sugar refining	135
Sulphate of ammonia	50,163
Sulphate of barium	821
Sulphate of copper	4,281
Sulphate of magnesium	2,436
Sulphate of zinc	572
Superphosphates	119,778
Tar and benzol	3,864
Textile uses	4,970
Sulphate of alumina (and other uses) : ...	
Unclassified Uses	18,742
Uses unknown	6,967
Total	355,423

Chemical Output Rising

1500 More Employed in May

THE number of people employed in making chemical and allied products in May this year was larger than at any time since the war, when, including workers engaged on explosives, the industry employed 438,100. The corresponding figure for May for chemicals, explosives, paints, oils, etc., was 349,600, an increase of 1500 on the figure for April and over 4000 more than at any time in 1946.

This evidence of rising activity is provided by the July *Digest of Statistics* now issued by the Central Statistical Office (H.M.S.O., 2s. 6d.), which shows fairly substantial rises of output from several sections of the chemical industry. Total production of sulphuric acid in May (in 000 tons) was 115.8, which was 6.3 better than the previous month and by far the highest output since January. Consumption of constituent materials rose proportionately but the stock position was fairly favourable.

(A fuller report will be given in next week's issue.)

Income Tax Assessment Procedure

Changes Resulting from Recent Legislation

THERE have been many changes during the past year in income tax assessment procedure, both administrative and legislative, and at this juncture it may be of interest to give a short explanation of these, together with other important maters. Particularly concerned are taxpayers under Schedule D (persons on own account; business profits), the relevant period being the year ended April 5, 1947.

Profits tax and excess profits tax payments are deductible, and interest received where treasury tax reserve certificates are taken out is not assessable. But any sum received as a post-war refund in connection with excess profits tax *is* assessable, and any interest received in connection with war damage value payments (not the capital sum) is chargeable with tax. Contributions made to universities and other educational institutions (even of a capital nature) in respect of technical instruction are allowed, if they relate to the particular trade of the taxpayer.

Such items as salaries or fees of scientific research workers, cost of materials and of repair and maintenance and so forth in connection with scientific research, are deductible as trading expenses. Furthermore, certain capital expenditure on scientific research (pilot plants, laboratories, etc.) is now allowed, this deduction, however, operating by yearly instalments over five years.

Trading Expenses

If an employer makes a contribution towards the purchase of savings certificates for his employees, part of that (usually one-tenth of the full amount) is allowed as a trading expense. Bonuses (*e.g.*, Christmas additions to remuneration) are taxable on the recipient, but the amount is deductible by the employer as a trading expense. Where employers have given goods as gifts to employees, these are not assessable, and if owing to the shortage of goods, savings certificates or other Government savings investments have been given instead, the recipient is not chargeable with tax.

Machinery and Plant Depreciation

Now obtainable is the new allowance for machinery or plant (the term a wide one, including motor vehicles and fittings and fixtures) of 20 per cent called an " initial allowance," where fresh machinery is installed. It applies equally to new or second-hand machinery, and is additional to the ordinary " wear and tear " yearly percentage allowances, which are now plus one-fourth and apply to every rate and unit. If, therefore, the basic rate is 20 per cent this is now 25 per cent. Moreover, if machinery is used more than usual (*e.g.*, on shifts or on overtime) ordinarily an extra allowance is obtainable; for motor vehicles in these cases the addition is one-quarter of the usual allowance.

A special depreciation allowance is now obtainable for buildings, machinery and plant erected or installed since December 31, 1936, as the date for determining whether the conditions for this allowance have been fulfilled has now been laid down as December 31, 1946. The Finance Act, 1947, allows a capital expenditure on all matters legitimately falling within the sphere of rehabilitation.

PARLIAMENTARY TOPICS

Match Industry Possibilities.—The c.i.f. value of imports of matches in the first six months of 1947 was £161,000 from Sweden and £231,000 from Belgium: Sir Stafford Cripps (President of the Board of Trade). —Mr. M. Orbach: While I agree that these amounts are comparatively small, may I ask my right hon. and learned friend if he is aware that if the production capacity of our home industry was fully employed, there would be no necessity for us to import any matches from abroad, in fact we could export matches?—Sir S. Cripps: That seems to follow from what the hon. gentleman has said.

£70 Recruits for Industry.—Asked what were the cost and the results of the Government campaign to attract women to enter industry, Mr. G. Isaacs (Minister of Labour) said that since the campaign started in June 7533 women had enrolled at Ministry of Labour Exchanges and more than 5000 were known to have obtained employment direct. The estimated cost of the campaign was £45,000.—Sir William Darling: Am I right in saying that the cost of each of these recruits is about £70 per head?—Mr. Isaacs: My mathematics do not go so far as working that out.

British Oil Earnings.—The total sales abroad of oil accruing from the operations of the British oil industry in 1946 represented about £100 million.—The Chancellor of the Exchequer.

An Alkali Inspector Sums Up—I

The Battle Against "Industrial Poisons"

by W. A. DAMON

THE story of a great U.K. industry, the manufacture of alkali products with its numerous associated ramifications, is reflected at many points by the application of the Alkali Act of 1863, its successor in 1906 and the various amending Orders which have helped to shape it.

The number of works originally registered under the Act was about 80. They are recorded on the first register. The number of registrations grew as the legislation was expanded until when the current Act was passed in 1906, the number stood at 1230 works embodying 1830 processes.

Since 1906, there has been a tendency towards amalgamation and the number of works registered has dropped to 1033, although the number of processes has increased to 1913. One can see the effect of this tendency very clearly on Tyneside where 50 years ago there were 21 saltcake and wet copper processes in operation. The last saltcake plant was closed in 1932 and but one wet copper works remains. In 1908 there were 37 chemical works on the Tyne registered under the Act. Now there are but 15.

Noxious Gases

Although there has been no revision of the Act itself since 1906, there have been Orders made under the Authority of the Public Health (Smoke Abatement) Act of 1926 which have had the effect of extending it. Such Orders were made in 1928, 1935 and 1939 and with these the Act now covers 27 processes which appear to be those potentially most offensive or dangerous from a health point of view.

Briefly, the Act provides that these processes (which are rigidly defined in a schedule) shall not be operated until they have been registered with the Ministry of Health and the major condition of registration is that the work shall be furnished with the "best practicable means" for reducing to a minimum the emission to atmosphere of noxious or offensive gases. Statutory limits of acidity are specified in connection with sulphuric acid chamber processes, concentration processes, saltcake processes and muriatic acid works.

The expression "best practicable means" is defined as having reference not only to the provision and efficient maintenance of appliances adequate for preventing the escape of noxious or offensive gases but also to the manner in which they are used. It is a somewhat elastic expression and its use as a condition of registration imposes on the inspector a duty of striking a fair balance between the desire of the community for unimpaired amenities and the just aspirations of manufacturers.

Consideration must be given to the possibility of recovering the waste gas in a useful form, the value of which may offset the cost of recovery. In this connection I would point out that quite frequently means which have initially been imposed on a somewhat unwilling manufacturer have later been developed to the point of becoming quite profitable.

Co-operative Spirit

I think it is generally conceded that the Act serves a useful purpose and I attribute its success to three main causes. The first is the precedent set up by the first Chief Alkali Inspector, Dr. Angus Smith, who invited and secured the willing co-operation of works managers rather than attempt to catch them out. I quote from page 61 of the First Alkali Report, *i.e.*, covering the year 1864:

"Beginning, as I did, with a strong desire to aid the public in the way most agreeable to the manufacturer, I could not forget that it was in his power to make the office of Inspector most difficult and disagreeable. I am happy, however, to say that in no instance has any act been performed to which we can in the slightest degree object. If in some cases the delay in making necessary alterations was greater than absolutely needful, it may be said that it was well to wait for full proof of deficient condensation and to satisfy the manufacturer of the accuracy of the statements."

Dr. Angus Smith wrote reports of great length and embodied in them his very sound philosophy of inspection. His reflections are well worth re-reading to-day. His policy has been continued ever since. It is more expedient and more expeditious to persuade than to prosecute.

Paying Proposition

The second cause is that in these days of competition every potential source of revenue must be examined and that many of what were at one time waste noxious products have been found to pay for recovery. It is in fact usually a paying proposition to clean up escaping gases and fumes. The third cause is the judicious recruitment of the inspectors from industry itself. Not only is the old saying about old poachers making the best gamekeepers true, but a man who has himself been responsible for

the operation of chemical processes is likely to approach a problem from a practical point of view and is certainly more likely to secure the co-operation of the responsible works officials.

The Alkali Inspectors have been charged with being old-fashioned. It is true that we speak of muriatic rather than hydrochloric acid. Within the meaning of the Act a works for the production of ferric sulphate is a "nitrate of iron works" and the process of decomposing common salt with sulphuric acid is an "alkali work." Our measurements are expressed in grains per cu. ft. and, as required by the Act, they are to be made at "60 degrees of Fahrenheit's thermometer and 30 in. of mercury pressure." Nevertheless, we have so far modernised ourselves as to discard the use of the words "phlogiston" and "alchemist."

Wartime Duties

It is, I suppose, inevitable that the Alkali Inspectors should be called upon to advise in all kinds of cases of complaint even though they do not relate to registered works. Just before the war they became involved in the matter of burning colliery spoilbanks. These often cover a substantial area and attain a height of 200 ft. When war was declared the matter became one of extreme urgency for the burning spoilbanks could be seen from the air at great distances. The alkali inspectors made a determined attack on this problem.

The most efficacious method of controlling spoilbank fires has been found to consist in continuous fine water spraying covering as large an area as possible and taking care that the water is sufficiently finely divided to soak continually into the mass. Where no water was available recourse had to be had to other methods such as covering with soil or clay. These methods were very successful and the spoilbanks were kept under control. Since the end of the war, however, the position has been deteriorating and a number of spoilbanks are again in a state of open combustion.

It is to be hoped that eventually some better method of dealing with spoil, (*e.g.*, underground stowage) will be developed, but the matter is not likely to receive much attention until the more urgent problems of coal mining have been solved.

So far as "Alkali" processes (*i.e.*, salt-cake processes) are concerned, there is no difficulty in maintaining a satisfactorily low escape. The process has in many instances been mechanised and made continuous by the use of rabbling arms in the decomposing chamber and absorption is now frequently effected in serpentine silica condensers instead of the old Gossage towers. The production of hydrochloric acid by this method has been largely superseded by its synthesis from chlorine and hydrogen. In either case, if an acid of more than 20 per cent strength is required, provision must be made for dissipating the heat of solution.

Cement Problems

Cement works have their own peculiar problem which relates to the emission of dust rather than offensive gas, though the latter is not unknown. The modern cement kiln consists of a long cylindrical slightly inclined rotating tube down which a slurry of chalk and clay in water is allowed to flow. At the lower end a great heat is developed by burning a blast of coal dust.

By the time the chalk and clay mixture has travelled the 250 ft. or more length of the kiln it has first become dried and then burnt to form cement clinker which is subsequently ground to produce Portland cement. At one point of its travel it has lost sufficient moisture to become friable and has not yet reached a temperature at which it clinkers. From this point the hot blast from the burners carries with it some dust which may eventually be emitted from the chimneys and deposited in neighbouring houses and gardens.

This problem has received much attention and substantial improvement has been effected: (1) by the use of chains suspended across the kiln at the wet end. The chains wetted with slurry not only act as a dust trap but also effect a saving in fuel. The chain system, from our point of view, should not extend beyond the point at which the raw materials reach a moisture content of 12-14 per cent. (2) By the use of external dedusters such as cyclones and electrical precipitators.

It is inevitable that industries should tend to concentrate in areas where by reason of availability of raw materials the conditions are favourable for their development. Thus, along the Thames Valley there is a productive capacity for 11,000 tons of cement per day. Although the slip of dust can be reduced to less than 0.4 grain per cu. ft., such a figure represents a total dust emission in the area of 30-35 tons per day.

Fewer Smelting Works

Smelting works in which sulphide ores are smelted are much less offensive than they used to be. 40 years ago there were about 80 such works, notably in S. Wales, in S.W. and in N.W. England. To-day there are less than 30. The calcination of tin ores is now practised in only three works. Smelting of lead ores has also been reduced and much of the preliminary roasting of copper and copper-nickel ores is now carried out overseas. At one smelting works the daily emission of sulphur dioxide was reduced by careful management from 14.3 tons in 1933 to 4.5 tons in 1938.

(To be continued)

SILICON ORGANIC COMPOUNDS—II

Resins, Varnishes, Silicone Liquids, Greases and Lubricants

by A. E. L. JERVIS and K. MOCHLINSKI

MOST of the troubles experienced in outdoor and indoor insulators are due to a combination of surface deposits and a humid atmosphere. Under most types of dry deposits the surface resistance remains high, but as soon as they become wet, the surface resistance decreases and surfaces become semi-conducting. To overcome this trouble, all sorts of peculiarly shaped insulators have been designed.

In the case of porcelain and glass the damp does not penetrate the insulator but is "adsorbed" to the surface and forms a more or less continuous film, able to short-circuit the insulator. Waxes and greases have been used in the past to persuade the deposited moisture to break into droplets instead of forming a continuous film, but they were only partially successful because of their relatively low softening point and their poor adhesion to the glass or ceramic bases.

In contrast with these, fired polymerised silicone surface films are claimed to be water repellent—under conditions of high humidity and condensation of water on their surfaces—for a long period of time. Silicone water-repellents were used during the final years of the war to safeguard radio and radar equipment against failures due to deposition of water-films on such ceramic parts as coil formers, bases for high frequency transformers and wire-wound resistances.

Resins and Varnishes

Developments in the field of silicone resins and varnishes make possible a considerable step forward in the insulation of electrical machinery and may considerably influence their future design. Organic resins and varnishes are the weak links thermally, when used in conjunction with inorganic materials such as glass, mica and asbestos. Since silicone varnishes and resins can be employed at high temperatures they make possible the full utilisation of the superior heat resistant qualities of inorganic materials.

While existing American standards allow the limit of 100°C. for class "A" insulation (purely organic—cotton, paper, etc.) and 120°C. for the class "B" insulation (inorganic base—mica, glass, asbestos, etc.) extensive tests show that class "B" insulation, with silicone varnishes replacing the organic ones, will permit a limit of 160°C. Machines of different sizes have been tested for very long periods under most adverse humidity conditions at temperatures reaching 300°C. with positive results. The output of some electrical machinery has been stepped up by as much as 25 per cent by the increase of temperature limits. In other cases the bulk weight of rotating machinery has been reduced by 20 per cent. Where temperature limits have determined the machine rating, the higher cost of new varnishes would seem to have been justified.

The advantages of silicone varnishes are that they enable the heat resistance of mica, asbestos, and glass to be utilised more efficiently, and they are reliable under difficult operating conditions. For example, when acids and moisture are present and temperature variations abnormal, they are fire resistant, and they contribute to economy of space, allowing bigger output from a given frame size.

There is a wide range of silicone liquids. Their behaviour is determined by the length of the basic chain and the number and type of cross linkages. Short, simple molecules form thin liquids, while more complicated ones form thicker liquids. Typical commercial liquids are shown structurally in Fig. 1, while Fig. 2 compares them with hydrocarbons. The viscosities and boiling points of the silicones in Fig. 1 are as follows:

Type	*Viscosity in cst*	*Boiling point °C*
Dimer	0.65	99.5
Trimer	1.0	152
Tetramer	1.5	192
Pentamer	2.0	230

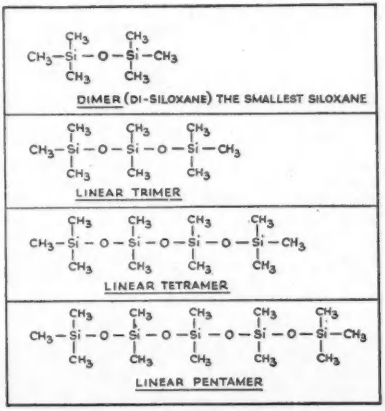


Fig. 1. Liquid silicones

Stability under extremes of temperature, slow change of viscosity with temperature, freedom from oxidation, chemical inertness and good electrical properties characterise these liquids. One typical silicone fluid having a viscosity near to that of the water freezes at -25°F. and boils at 300°F. The change in viscosity of a typical silicone oil for a given change of temperature is 14 times less than that of a typical petroleum oil.

The principal applications of silicone liquids are as instrument oils, hydraulic oils, dielectric fluids and condensation pump oils. Silicone fluids have also found many applications in aircraft navigational equipment operating under extremes of temperature.

Because of their smaller surface tension, silicone liquids are characterised by a flat meniscus and are therefore very useful for manometers. Another interesting application is the use of minute additions of silicone oil to prevent foaming, a very important consideration in oil circulating cooling systems. Their high stability and good electrical properties suggest the use of silicone oils for the oil-filled capacitors. They can also be employed as cooling oils for transformers. They are particularly advantageous at high frequencies, because of their very low power factor.

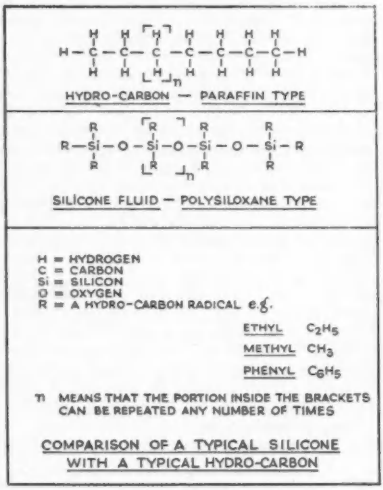

HYDRO-CARBON — PARAFFIN TYPE
SILICONE FLUID — POLYSILOXANE TYPE
H = HYDROGEN
C = CARBON
Si = SILICON
O = OXYGEN
R = A HYDRO-CARBON RADICAL e.g.
ETHYL C_2H_5
METHYL CH_3
PHENYL C_6H_5
n MEANS THAT THE PORTION INSIDE THE BRACKETS CAN BE REPEATED ANY NUMBER OF TIMES
COMPARISON OF A TYPICAL SILICONE WITH A TYPICAL HYDRO-CARBON

Fig. 2

Greases and Lubricants

In general, silicone greases can be characterised as waterproof, chemically inert, oxidation resistant, relatively non-volatile, and very stable under a wide range of temperature variations. These qualities have led to the use of silicone greases as lubricants for ball-bearings having to work under adverse temperature conditions, glass and ceramic stopcocks, pressure lubricated valves, oxygen supply lines to rotating aircraft turrets, high temperature controllers used as oven timers, and fluorescent lamp tubing (during manufacture).

For lubrication of high-speed bearings working in extremes of temperatures special greases, thickened with carbon black (or silica white) and metallic soaps have been produced. One typical example of silicone lubrication working under very difficult conditions is noteworthy. Thirty thousand small D.C. aircraft motors with 4 m.m. dia. ball bearings, were successfully lubricated. These motors had to operate at temperatures of -85°F. and below. Rapid starting and rapid attainment of full speed (10,000 r.p.m.) were essential.

Sealing Compounds

Silicone sealing greases, used for preventing breakdowns in aircraft ignition systems are one of the most popular of the silicone compounds now in commercial use. Because of the reduced air pressure associated with high altitude, corona discharge led to very frequent failures of ignition systems. This very urgent problem of military aviation was solved by using the silicone compound in the form of a grease, having high dielectric strength, which does not harden or flow between -40°F. and 400°F., and which is at the same time moisture resistant and non-hydroscopic, as well as chemically inert towards the insulation materials. Applied to spark plug wells and disconnecting junctions, it excludes air from them and prevents the formation of short-circuiting water films. When arcing does take place, the principal decomposition product is silica and tracking is therefore not as serious as with the ordinary organic insulation.

Mainly because of its high electrical resistivity and moisture excluding properties this particular silicone compound has been also widely used in radio and radar systems.

(Concluded)

Chromic Acid Shortage

Chromic acid is in short supply, and means of conserving it are therefore of interest to producers of chromium plated goods. A technical note on its conservation has been prepared, and copies may be obtained from the Secretary, Metal Finishing Committee, Ministry of Supply, c/o W.R. (D)2, Room 1033, Shell Mex House, Strand, W.C.2. Inquirers should ask for: Supplement to E.T.A.C. Technical Memorandum No. 1, "Conservation of Chromic Acid during periods of shortage."

SYNTHETIC PRODUCTION OF PETROLEUM—I

Hydrogenation and Fischer Processes

by MAJOR KENNETH GORDON*

THE Fischer process for the manufacture of petroleum products from coal is a true synthetic one since the hydrocarbon molecules are produced by building up complex molecules from carbon monoxide and hydrogen. The product made by the hydrogenation process, although commonly referred to as synthetic petrol, is not synthetic in the true sense of the word at all since it is produced by the breakdown of the more complex molecular constituents of coal itself, or its derivatives such as tar.

It is not possible here to deal with the subject more than briefly. For a more detailed survey of the development of these synthetic processes in Germany the report to be issued shortly by the Stationery Office (" Report on a Study of Liquid Fuel Processes in Germany ") should be consulted.

Hydrogenation Problems

In the hydrogenation process, coal is converted into liquid hydrocarbons by the simplest and most direct method possible. Neglecting the minor constituents of coal, such as oxygen, sulphur and nitrogen, and attributing to each of these the hydrogen required for its elimination as the appropriate compound, the empirical composition of the remaining hydrocarbon constituents of coal is approximately CH_8.

The empirical composition of the petroleum products we desire to manufacture is approximately CH_2. In the hydrogenation process the requisite quantity of hydrogen is added at a suitable pressure and temperature in the presence of an active catalyst. In the case of coal itself we have the complication that we are dealing with a solid which contains a certain amount of mineral matter, however carefully the coal is cleaned. The elimination of this mineral matter, together with a small proportion of the more resistant part of the coal which remains as a solid, is one of the difficulties of the process. Further, it has not so far been practicable to introduce coal into the high pressure vessels in its solid state, and it is usual to mix it with its own weight of heavy oil so that it can be handled in pumps.

These complications involve recycling considerable quantities of materials through the plant with the attendant losses. The solid residue is eliminated by a combination of centrifugal treatment and distillation, and, of course, it can be consumed as part of the fuel requirements of the factory.

The crude hydrogenation product from coal covers the same sort of boiling range as does natural petroleum. The fractions boiling below 180°C. are substantially pure hydrocarbons. The fractions boiling above 180°C. contain substantial amounts of phenols and smaller amounts of organic bases. These higher boiling fractions are commonly known as middle oil and have to be hydrogenated in a second stage for conversion to hydrocarbons.

Four Stages

For the treatment of coal under the most favourable conditions one would say that four stages are at least theoretically desirable. In the first stage the solid coal is converted to a mixture of oils. In the second stage the heavy oil fraction not susceptible to treatment in the vapour phase, is hydrogenated in the liquid phase. In the third stage the middle oil produced from this source is given a light hydrogenation treatment which we call " saturation", of which the main purpose is the elimination of nitrogen compounds which poison the catalyst in the last stage. In this last, or " splitting " stage, the hydrocarbons are broken down to those of the required molecular weight.

During the course of these stages a substantial proportion of the hydrocarbon material is broken down to lower molecular weight compounds than are necessary, and they appear as the hydrocarbons methane, ethane, propane and butane.

In the early stages of the process, where conditions are such that no more active catalyst can be employed, these hydrocarbons are found in practically equal proportions by weight. In the latter stages, where extremely active catalysts are employed, we find that there is a big preponderance of butanes and particularly isobutane, a smaller amount of propane, and scarcely any ethane or methane at all. The formation of these hydrocarbons involves a lower yield of liquid products than is theoretically possible, and, of course, the consumption of more hydrogen than is necessary for making liquid products.

The overall yield from the hydrogenation process depends upon the raw material and upon the product which is being made. From bituminous coal we can obtain rather less than 50 per cent of aviation spirit and rather more than 50 per cent of ordinary

* Paper presented in the symposium, " Newer Derivatives of Coal and Petroleum " at the University of St. Andrews.

motor spirit. At the other end of the scale, from a light distillate oil made either from brown coal or bituminous coal tar we can get yields as high as 90 per cent. The amount of hydrogen similarly varies from figures in the region of 3600 cu.m. to 1000 cu.m. per ton of finished product.

German Procedure

The processes employed in Germany have operated from 200 atmospheres to 700 atmospheres pressure. The newest German plants worked at 700 atmospheres, but it is rather doubtful whether such a high pressure is really necessary. Pressure of 200-300 atmospheres, which was employed in the earlier plant is undoubtedly on the low side, and it is probable that some intermediate figure would be the best.

The engineering problems connected with the hydrogenation process may be regarded as completely solved. The German plants at the end of the war had a capacity of some 4 million tons a year. In this country we have hydrogenation plants with a capacity of approximately 500,000 tons a year.

A part of the process where an improvement is desirable is that connected with the recovery of oil from the solid residue. Also the discovery of some more active catalytic conditions which could be employed in the presence of coal itself would be a great improvement. It is difficult to see, however, how anything sufficiently revolutionary to alter the general economic picture can be forthcoming.

Rising Costs

The survey of the costs in Germany, translated into English conditions, which is given in the forthcoming report to which I have referred, indicates that the capital cost would be of the order of £60 per ton year of product, and that the operating cost, including amortisation but no profit, would be in the region of 2s. per gallon, or nearly four times the cost of imported petrol.

It will be appreciated that the prospects for hydrogenation or any other synthetic oil process have become very much more unfavourable since serious work started on it in this country 20 years ago. The cost of coal has multiplied by four since those early days, the cost of labour has increased to over double what it was then, and the cost of other materials has risen correspondingly, whereas the value of the product, neglecting the question of protective duty, has remained very much as it was then. But its quality, and hence its cost of production by any means and from any source, has increased

The properties of the petrol produced are extremely favourable for all purposes. This is due to two causes. The structure of coal is undoubtedly such that breakdown during the process gives cyclic hydrocarbons. Further, the very active catalytic conditions employed in the vapour phase stages of the process give isomerisation to the most stable hydrocarbons, that is to say, iso-paraffins and naphthenic compounds, which are of great value from the point of view of knock rating.

Whether a petrol has been derived by hydrogenation can indeed easily be detected by its composition, a fact that was of some little value to us during the war since the Germans were kind enough to present us with frequent samples of aviation petrol in various parts of this country.

High Grade Spirits

The properties of the petrol from every other point of view are equally good, as one would expect from the nature of the process employed. The sulphur content is very low, the tendency to gum formation almost absent, and the volatility, upon which the starting properties depend, can be controlled to any desired degree.

Straight petrol can be made with an octane number of anything up to 80. By the addition of lead this figure is increased to 95 or so. If a better petrol than this is required for aviation spirit, then the iso-butane which is made in substantial quantities when high volatility is aimed at, can be converted to iso-octane, and this process was employed both at Billingham and at Heysham during the war.

The hydrogenation process is not without interest as a source of chemical materials. Propane and butane, for example, have now been available for some years, and they can easily be converted into their corresponding olefins by dehydrogenation. Iso-pentane is also available in substantial quantities and from this many organic compounds can be made by oxidation. Cyclo-hexane is another important constituent and this can give rise to cyclohexanol and cyclo-hexanone by hydrogenation and to benzene by dehydrogenation.

Substantial amounts of phenol, cresol and xylenol are present in the crude products made by hydrogenation of both coal and tar, are easily separated, and are a valuable contribution to revenue.

(To be continued)

Italian Rubber Industry

Raw materials for the Italian rubber industry are reported to be in better supply. About 11,000 tons of natural and synthetic rubber are expected to arrive between now and the end of the year. The outlook for 1948, however, is not so bright because there is a shortage of dollars in Italy, as well as elsewhere. Manufacturers are unlikely to receive much help from the Government, which is already finding it difficult to find enough dollars to pay for coal, petroleum and iron.

NEW YORK BARS NITRATE CARGOES

SHIPS ORDERED TO QUIT THE PORT

AMERICAN reaction to the fresh evidence of the dangerous potentialities of ammonium nitrate, exhibited by the recent disastrous explosion at Brest, is reflected by the action of the New York Fire Commission on July 30 in ordering two ships loaded with ammonium nitrate to be removed immediately from the Port of New York, describing them as a " serious menace to the people of the city." The steamships, *Molda* and *Madaket*, each carried 3000 tons of the nitrate.

" Danger Money " Demand

The 7850-ton S.S. *Molda*, operated by the Cosmopolitan Shipping Company, was scheduled to pick up a general cargo in New York. Prior to her withdrawal from the port, longshoremen walked off the Europe-bound freighter after their demand for " munitions " pay was refused. Eighty longshoremen demanded that they receive double their usual rate of pay of $1.65 hourly. $3.50, it was pointed out, is the standard hourly pay-rate for loading munitions ships. In refusing the demands of the longshoremen, operators of the *Molda* pointed out the classification of ammonium nitrate has not been changed to dangerous and that until such a change is made regular loading rates should prevail. Meanwhile, the *Molda* is anchored at the ammunition anchorage of Gravesend Bay.

The second vessel ordered out of the port, the 6165-ton S.S. *Madaket*, operated by the Waterman Line, sailed for Antwerp, Rotterdam and Bremenhaven without waiting for her 1200 tons of general cargo to be put aboard. The Waterman Company, through its general Eastern traffic manager, has pointed out that the Bureau of Explosives of the Association of American Railroads, in its report on ammonium nitrate, "after exhaustive tests under the most adverse conditions," failed to determine that this commodity was "highly explosive," as described by the Commissioner. The company also points out that thirteen fruitless attempts had been made to explode ammonium nitrate. These attempts included firing a rifle bullet into the compound, detonating it with detonating caps and dynamite, tossing quantities of it into fires, heating it up to 700°F., and subjecting it to impact and friction tests.

Current Regulations

Present regulations governing ammonium nitrate prohibit the loading or unloading of the chemical at New York piers. Ships arriving in New York with ammonium nitrate in their holds are required to keep the holds battened down. No other cargo is permitted in the same hold and, in addition, a detail of uniformed firemen, as well as department inspectors of combustibles, is assigned to such ships as soon as they dock.

As a result of the Brest explosion, Douglas Wise, vice-president of the Terminal Shipping Company, Baltimore, has announced that the ship had taken more than 3000 tons of ammonium nitrate. He said that the company, remembering the Texas City disaster last April, took unusual precautions with the cargo.

New Fire Precautions

Meanwhile, in Norfolk, Virginia, on July 24, strict rules affecting the handling and storage of ammonium nitrate were adopted by the City Council. In Washington, D.C., one official expressed concern that the Brest explosion might lead to " prohibitive insurance, stevedoring, freight and storage rates, making it impossible to carry out the world nitrogen fertiliser programme."

Nitrate Ship in Flames

Ten Killed by Melbourne Explosion

FIRE and explosions among drums of sodium nitrate in the hold of the British *S.S. Mahia* in Melbourne harbour last week resulted in the deaths of 10 dockers and painters, who were stated to have been trapped below decks by the rapidity with which the blaze spread. The rest of the ship's £100,000 cargo, composed largely of match sticks and newsprint, almost immediately was ablaze and after efforts to control the flames had continued for seven hours, holes were cut in the vessel's sides and she was sunk in 35 ft. of water. On the quays nearby were oil stores, stacks of newsprint and timber. About 200 yards away was a gasworks.

The secretary of the Watersiders' Union later said that the explosion would " strengthen demands that explosives should not be handled at Australian wharves."

Nitrate Alarm in Belgium

Firemen at Renaix, on the French border of Belgium, extinguished a blazing wagon load of nitrate of ammonia in the railway station, after police and railway officials had warned the whole town that it might be necessary to evacuate the locality. The cause of the outbreak has not been definitely established and the theory current is that it arose spontaneously during a period of intense heat.

NEW DEGREES FOR TECHNOLOGISTS

Parliamentary and Scientific Committee's Proposals

THE development and extension of technological education and conferment of greatly improved status on technical colleges are recommended in the 10,000-word report which the Parliamentary and Scientific Committee submitted last week to the Lord President of the Council and the Minister of Education on "Colleges of Technology and Technical Manpower." The report was prepared by a special sub-committee under the chairmanship of Mr. W. T. Wells, M.P., and its membership included Prof. Alexander Findlay (president of the Institute of Chemistry), Dr. H. J. T. Ellingham (the Institute of Chemistry), Dr. R. E. Slade (past director of research, Imperial Chemical Industries, Ltd.), Mr. G. L. Bailey (British Non-Ferrous Metals Research Association), Dr. J. R. Scott (Research Association of British Rubber Manufacturers), and Mr. Cecil Dixon (Association of Scientific Workers).

University Standards

The report is concerned only with the major technical colleges, those having technological courses equivalent to university degree courses. At present some 27 colleges, ten of them in the London area, provide full-time higher technological courses of up to three years' duration and it is intended to raise others to this standard. The sub-committee, in its introduction to the report, stresses the marked lead which other countries enjoy and are now increasing in technological education and the benefits that has conferred upon their industries, notably in the commercial application of scientific discoveries originally made in this country, and affirms that: "With adequate provision for higher technological education, this country could again secure the benefits of our technical and scientific achievements in the development of our industries, reach equality with our competitors in technical manpower and regain our pre-eminence in the markets of the world."

In the past (says the report) there has prevailed in certain quarters an unjustified belief that it was not appropriate to extend university recognition to technological studies on the ground that the content of the courses did not warrant it. However, it is now more widely appreciated that the study of a technology necessarily involves a thorough groundwork in the pure sciences. It has been contended that students should attend a pure science degree course and should acquire their knowledge of technology in a post-graduate year. However, an adequate study of many branches of technology cannot possibly be made in a post-graduate year.

It is therefore contended (a) that the study of selected branches of technology presents a problem which cannot be solved by devoting to it a post-graduate year, and (b) that therefore the study of selected branches of technology, together with the appropriate basic scientific foundation, should lead to the award of a degree with national and international currency in order to attract into these courses a fair proportion of men and women of high ability.

Recommended Subjects

The committee points out that many colleges of technology do prepare students for university degrees. But others have not been so recognised and have had to rely on the University of London external degree as their ultimate reward.

As a result of a questionnaire to principals of technical institutions, the following branches of technology were recommended as being suitable for the award of a degree: Mechanical engineering, electrical engineering, civil engineering, chemical engineering, production engineering, structural engineering, mining, metallurgy, surveying, building, architecture, textiles technology, oil (petroleum) technology, pharmacy, rubber technology, plastics technology, technology of paints, varnishes and lacquers, industrial fermentation, colour chemistry and dyeing, ceramics (pottery), food technology including nutrition.

Facilities for degree awards in most of these subjects are either inadequate or non-existent, the committee affirms.

Award Authorities

The excellent work done by professional institutions in the award of qualifications is recognised and it is anticipated they will give valuable assistance to regional organisations and a National Council of Technology.

These organisations, recommended by the Percy Committee and accepted by the Minister of Education, would consist of an Advisory Council and an Academic Board for Advanced Technology in each of the ten regions into which the county would be divided for the puruposes of higher education. The Advisory Councils would be concerned with the organisation and development of higher education and the Academic Boards, composed principally of heads of universities and colleges of technology and members of teaching staffs, would be responsible for the development and co-ordina-

tion of advanced technology and establishment of good working arrangements between the university and college staffs.

The regional machinery will have its national counterpart in a central body, which, the Minister has suggested, should be entitled the National Council of Technology and which should be at least partly representative of the Regional Advisory Councils and of the Regional Academic Boards. No detailed proposals of the constitution of the National Council have been made, but it would be responsible for considering the national aspects of regional policies, for consultations with the University Grants Committee and for advising the Minister of Education.

Awarding Degrees

The recommended solution to the problem of qualification is that the local university should extend its recognition to appropriate departments of the colleges of technology and award degrees. If, however, in any particular region, this procedure cannot be adopted, the National Council of Technology, in conjunction with the University Grants Committee, is the organisation to which the problem can most suitably be referred. The National Council of Technology might, itself, award degrees or consideration might be given to the establishment of one or more organisations for granting degrees on a national or geographical basis.

Another of the sub-committee's objectives is to stimulate and widen the comparatively small amount of research work now carried on by the technological institutions and to encourage the training, by the publication of papers and award of higher degrees, of post-graduate research workers. At the moment, the report notes, although the colleges are full to overflowing the number of students who plan to undertake research work will in all probability be small.

Better Salaries

Courses of study envisaged will demand highly qualified lecturers and more expensive and specialised equipment. Staffing with highly qualified lecturers will depend upon salaries offered and conditions of service. In this connection, the report notes that the Percy Committee recommendation that colleges of technology should offer to staffs salaries and conditions similar to those at the universities has not yet been accepted and the provisions of the report of the Burnham Committee on salaries of teachers in colleges of technology do not adequately meet the problem.

Lecturers in colleges of technology are paid on a Burnham basic scale with a minimum of £300 rising by £15 to a maximum of £525 for men, and a minimum of £270 rising by annual increments of £12 to a maximum of £420 for women. This basic scale which is offered to lecturers in advanced subjects, who must also usually be capable of research in their subject, is exactly the same as that offered to teachers in primary schools dealing with pupils of the age range 5 to 11. It is ridiculous to suggest that these scales attract satisfactory lecturers to the colleges of technology. They do not. Many colleges of technology, in fact, cannot obtain satisfactory teachers of advanced subjects.

To maintain the standard of work, and to secure the employment of highly qualified staff, the Minister (the report recommends) should invite the Burnham Committee to make provisions for special scales of salaries applicable to the staffs of the selected departments of colleges of technology comparable with those for staffs of universities. A head of a department (or professor) might, for instance, be paid a minimum basic annual salary of £1400; a senior assistant (or reader), £800 to £1200; a lecturer, £400 to £850, with appropriate family allowances.

Emphasis on Applied Science

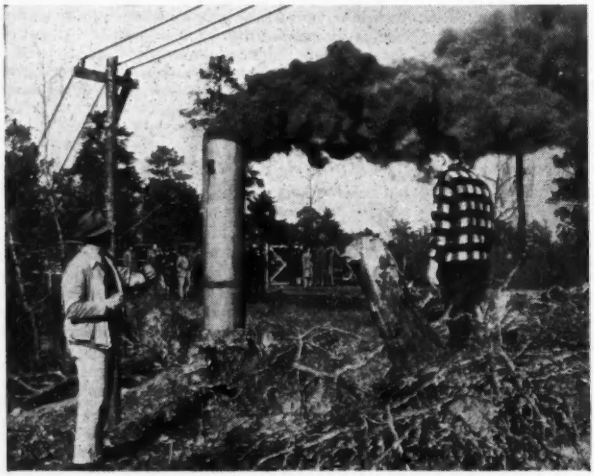
In summarising its recommendations, the sub-committee recalls that the report prepared by Dr. V. Bush (Director of the U.S. Office of Scientific Research and Development) at the request of the late President Roosevelt, urged that in future America should pay increased attention to discovering fundamental knowledge no longer available from war-ravaged Europe. The aim in this country, says the sub-committee, should be to pay more attention to applied sciences, without, however, prejudicing needed developments in academic education in all its forms. "Our colleges of technology must be adequately staffed, well equipped, and fully recognised as of university rank. Then, and only then, will they be able to make an adequate and essential contribution to our industrial prosperity and national well-being."

Among other points raised in the report are a recommendation that students wishing to undertake research after their bachelor degree should do their national service training on leaving the secondary school; technical state scholarships for students wishing to study to a high standard should be increased in number and more widely publicised; consideration should be given to the establishment of loan funds for promising students in colleges of technology; and that reasonable freedom should be given to influential and representative governing bodies of colleges in directing the affairs of the colleges and incurring expenditure within the approved estimates.

U.S. UNDERGROUND GASIFICATION

Openings into the isolated seam for observation of the burning coal and, above, pipes for sampling gas and recording temperatures

Underground gasification of coal, pioneered by Russia in the past ten years, is now being intensively studied by other countries. In the United States an experiment was recently conducted at Alabama, to find out whether gasification *in situ* was an economic proposition. A small 36-in. seam of coal was isolated from the main seam and prepared for burning. A relatively thin overburden—about 30 feet—prevented high pressures of air and steam being used, so the temperature could not be raised above 2000°F. The best results were with oxygen and steam blasting, which yielded a gas with a value of 220 B.Th.U. per cu. ft. Some of the surface installation is shown in these pictures.



Smoke and gas from the burning coal issuing from one of the two 40 ft. exhaust stacks. Each stack, together with air and steam pipes, was built into one of the gallery entrances so that air or steam could be blown in at either end

SCENES AT THE ALABAMA EXPERIMENT

One of the points for observing the burning coal was fitted with a Pyrex glass window through which direct observation can be made. Thermo-couple and gas connections are fitted to the door

Canadian Chemical Notes

Widespread Search for More Agricultural Chemicals

MR. W. B. TIMM, Chief of the Bureau of Mines, has just told a Canadian Senate Committee that it was too early to state if recent potash discoveries in Saskatchewan and phosphate in the Saguenay district are in quantity and value to be worked economically. He was testifying before the Resources Committee of the Senate, which is inquiring into the possibilities of making Canada self-sufficient in chemical fertilisers. The preliminary investigations on a motion of Senator J. A. McDonald (Nova Scotia) will be carried to completion next session. Canada, said Mr. Timm, now is importing phosphates for fertilisers from Florida and Montana and potash from New Mexico and California.

* * *

Since May 18, plant scientists of the University of Manitoba have been attempting to determine what damage to wheat, oats, barley and flax results from applications of two forms of 2, 4-D, the chemical weed-killer. Prof. P. J. Olson said conclusions regarding his experiments will not be reached until harvest time, when yields per acre can be calculated. By then scientists in various parts of North America expected to present their findings to a convention. A corn plot treated with 2, 4-D was virtually free of weeds. Barley, in another plot, appeared to be " taking a beating," but it will not be known until fall whether the yield was lower or higher than average.

* * *

Preliminary details of anticipated output are now available relating to the new chlorine and caustic soda plant, which, as already announced, the Dominion Alkali and Chemical Co., Ltd. (subsidiary of the Dominion Tar and Chemical Co., Ltd.) is to erect at Beauharnois, Quebec. The plant, for which the H. K. Ferguson Co., industrial engineers and builders, has been awarded the contract, is intended to have a daily output of 60 short tons of chlorine and 67 short tons of caustic soda of rayon grade. Hydrogen will also be produced on a commercial scale. Building is to start almost at once with a view to starting actual production in January.

* * *

Preference shareholders of Standard Chemical Co., Ltd., unanimously approved a by-law authorising the issue of a further 20,000, 5 per cent cumulative redeemable preference shares in excess of the 10,000 shares now outstanding. The proceeds will be used in part to provide for continuance of current expansion.

American Chemical Notebook

From Our New York Correspondent

A SERVICE school in petroleum chemicals on a post-graduate level has been established by the E.I. Du Pont de Nemours Company as the first step in an enlarged research, sales and technical programme. The course in the "industrial college" combines practical and theoretical aspects of petroleum chemistry and extends over many months, depending on the subject matter and the degree of specialisation sought. The technical background of the men enrolled embraces collegiate studies in chemistry, automotive, mechanical and petroleum engineering, plus a substantial amount of specialised practical experience. After an introductory course at Du Pont's Delaware, headquarters, the students transfer to the Deepwater Point, New Jersey, plant for courses in lubricating oils and petroleum additives. Their next studies are at the petroleum engineering laboratory on engines, fuels and their performance, practical application of additives and their uses and how anti-knock mixtures react in fuels. Students finally specialise in various lines for about five months. At the end of the course the graduate is assigned to various Du Pont districts.

* * *

The United States armed forces wasted the technical skill of 40 per cent of the chemists and chemical engineers in World War II, according to a survey made among its members and just released by the American Chemical Society. A report prepared by the society, on the basis of the survey, recommends immediate formulation of a comprehensive programme for efficient utilisation of technical manpower, both inside and outside the military services, in the event of another national emergency. Of 31,000 members of the American Chemical Society 4506 (about 15 per cent) were in the armed forces. About 58 per cent were detailed to industry, 17 per cent were on government-sponsored research, and 8.5 per cent were concerned with teaching. Pointing out that many chemists entered the Services through the organised reserve corps, the report declares: "Of these about 35 per cent were not properly utilised. Those holding the doctorate degree fared somewhat better, with about 20 per cent reporting improper utilisation. Similar percentages hold for those who accepted direct commissions. Among those who voluntarily enlisted or were drafted, the percentage who claim improper utilisation is much greater. Lack of trained personnel people, job analysts, and pressure of active combat fronts were among factors that contributed to the failure to use more of our scientific personnel as efficiently as was possible." Many men who were in the organised reserves or who accepted commissions were assigned immediately to purely military duties, the report continues, and many others were lost to important production jobs when they enlisted or accepted commissions because they felt it was their patriotic duty or because of the attitude assumed by some draft boards. "Approximately 78 per cent of the members reporting military service were below 35 years of age, and of these almost 50 per cent report improper utilisation," the report states. In all, the poll indicated that almost half of those in military service were improperly used in regard to their scientific training. The report concluded that: "A large portion of our scientific manpower was not efficiently utilised."

* * *

During the war a new, accurate and rapid method to determine the volume of water in paints and varnishes was developed by the (U.S.) Paint and Chemical Laboratory Branch for the Ordnance Research and Development Centre. The process is a further application of the Karl Fischer reagent, also used for water determination in oils, fats, waxes, glue, plasticisers, and many other substances. The titrimetric method requires only one hour to determine to 0.1 per cent the amount of water in any varnish and almost any paint. In addition to its speed and accuracy, the new water-analysis method has the advantage of requiring only small samples. The analytical procedure calls for weighing 10-20 grams of paint or varnish into a carefully dried glass-stoppered flask to which anhydrous pyridine is added from a burette. Almost 10 ml. is used for thinned samples and up to 25 ml. for unthinned. The mixture is then swirled thoroughly and 25-50 ml. of Karl Fischer reagent is added at once. Next the flask is stoppered, placed in a water bath at 50° C., and swirled at 10-minute intervals for 45 minutes. The flask is then allowed to cool, after which electrical titration is accompanied by adding pyridine containing 0.1 per cent of water. The standardisation of reagents completes the operation. Details of the operations, including determination of interfering substances, such as zinc oxide, are given in a report (No. PB-52027, "Volumetric Determination of Water in Paints and Varnishes") which is being placed on sale in microfilm or photostat form for $1.00 this week by the Office of Technical Services.

* * *

The United States Department of Commerce has reported that manufacturers'

sales of chemicals and allied products dropped almost $400 million in May from April sales of $850,390,000. The drop of 14 points in the index of value of deliveries by the chemical industry, however, was due in large part to a commensurate drop in prices during May. While the physical volume of products sold varied little from April, price declines centring in fats and oils and in the drug-pharmaceutical-cosmetic group brought the dollar volume down to $810,480,000. The May value of shipments was, however, still more than two-and-a-half times greater than average monthly pre-war shipments of $330,700,000. Manufacturers' inventories in the chemical and allied industries rose 6 per cent in May to a total of $1,584,600,000.

* * *

Conditions in the United States for the chemical industry as a whole continue to be favourable. In many instances chemical companies are expanding plant facilities, new plants are being opened, and new ventures are being undertaken. Production is at near capacity for almost all companies and in general a healthy atmosphere pervades the industry. The strong demands for chemicals from the synthetic textile industries, the plastics and other fields continue to keep production at peak level and financial reports show that most, if not all, companies are enjoying record or near-record profits. The Davison Chemical Corporation's earnings for the fiscal year ended June 30, 1947, are estimated at approximately $1,650,000 by Chester F. Hockley, president. Sales were approximately 25 million dollars, the best for any peacetime year, an increase of about $1,700,000 over the previous year. The Monsanto Chemical Company's sales during the six months ended June 30, 1947, amounted to $71,085,736, an increase of 41 per cent over the corresponding period of 1946. The company's net income for the period was $9,275,133. "Excellent progress is being made at Texas City on reconstruction." said the chairman (Mr. E. M. Queeny). "Clearing of the site has almost been completed." The company's present net income is more than $3 million better than in the corresponding six months of 1946. The Hercules Powder Company, in the six months ending June 30, showed a net profit of $7,312,900. The General Electric Company, in the first half of 1947 had a net income of $37,979,536 after all deductions, including $23 million for taxes. The Union Carbide & Carbon Corporation and its subsidiaries have just reported a consolidated net income of $16,886,312 for the second quarter of 1947. Consolidated net income for the six months ending June 30 was $36,071,419, as compared with $24,657,976 for the same period of 1946.

The Office of International Trade of the U.S. Department of Commerce has just announced allocation of 120,000 short tons of tin plate to foreign nations for the fourth quarter of 1947. These allocations, it was announced, are to be given priority assistance and be used for packing of perishable food products abroad. An additional 22,000 short tons of tin plate for packing of U.S. imports, including oil products, will also be available for foreign use but no supply assistance will be granted by the Office of International Trade. Latin America and Europe received allocations totalling 42,925 tons and other allocations were: Australia, 12,800 tons; Brazil, 10,500; Argentina, 9000; Netherlands, 9500; Belgium, 6500; France, 6300; Norway and South Africa, 6000 each.

* * *

Two special 300 h.p., 240 r.p.m. inert-gas-filled synchronous motors now being built by the (U.S.) General Electric Company for use in an inflammable atmosphere incorporate all necessary features in one design. The enclosure has built-in coolers and a sealed chamber which is filled with a non-combustible gas and the gas is under sufficient pressure so that any leakage will be outward and no air or inflammable gas will get into the motor. By removing only one access cover, the field leads, stator leads, terminal boards, and bridge resistors for the temperature relay are accessible. The inert gas follows unrestricted flow lines in the cooler, which is located over the motor, to give efficient heat transfer. Resistance temperature detectors are imbedded in the stator windings and are used with a temperature relay to remove the motor from the line in the event of the temperature of the stator windings becoming excessive.

* * *

One of the disadvantages in the use of metallic yarn for dress fabric, is its susceptibility to tarnish. A U.S. plastics manufacturer, it is reported, is now marketing a thin aluminium yarn covered with a plastic material in which gold, copper or silver hues have been impregnated. In addition to being lighter in weight than the earlier metallic cloths, the new fabrics can be washed or dry-cleaned without ill-effect.

Plates from Cellulose Fibres

With the active participation of the Dynamit A.G., formerly Alfred Nobel & Co., the Eifel Cellulose Company has been established. At Dollendorf this firm will produce plates of cellulose fibre by a new manufacturing process. All kinds of timber waste and slabwood, including broom and heather, will be used as raw material.

High Capacity Mercury Cell

New U.S. Aid to Caustic Soda Production

THE production of a stationary mercury cell which produces caustic soda of high purity and offers certain operating economies is announced by The Mathieson Alkali Works, of New York. The new cell produces 50 per cent liquor directly at the cell, a much more concentrated solution than is ordinarily obtained. Also, as compared with European mercury cells, it is claimed that it conserves floor space, requires less power and makes use of less costly construction materials. Under development for 17 years, a small commercial installation of the stationary cell has been in operation at Mathieson's Niagara Falls plant since 1939.

Licensing arrangements, on a royalty basis, are available to companies in foreign countries and under certain conditions to companies in the U.S.A. Licences have been granted to companies in Canada and South America and plants are now under construction. Development of the new cell was initiated by Colonel C. F. Vaughn and carried on by Dr. William C. Gardiner.

Two Processes

The new cell incorporates a number of Mathieson discoveries which have resulted from more than 50 years of experience with mercury cells. Such cells produce caustic soda by the electrolysis of brine in two stages. In the first stage, sodium amalgam and chlorine are formed. In the second stage, the amalgam is decomposed to form caustic soda and hydrogen.

The new cell consists of two chambers, an electrolyser and a decomposer, between which is a pump. In the electrolyser, brine contacts a mercury cathode and a graphite anode. In operation, direct current is passed through the electrolyser, forming sodium amalgam at the cathode and chlorine gas at the anode.

The sodium amalgam is pumped to the decomposer, where it becomes the anode (graphite packing constituting the cathode). The sodium of the amalgam reacts with water in contact with the graphite packing, to form caustic soda and hydrogen gas. The mercury, now practically freed of sodium, is recirculated to the electrolyser.

The anode has a flexible connection, which permits it to be raised or lowered, thus allowing the anode-to-cathode distance to be adjusted frequently to the most economical space without interrupting the cell current.

The chlorine released at the bottom of the anode escapes through slots in the graphite, thus permitting the chlorine to pass rapidly to the upper surface of the anodes.

The decomposer is a vertical tower filled with graphite packings. This provides a very short anode-to-anode distance, an important consideration for efficient decomposition. The tower is flooded with amalgam which enters at the top; pure water is introduced near the bottom and forces its way upward in a very thin film between the amalgam and graphite surfaces.

Among the advantages claimed for this cell, compared with existing European equipment, is the presence of calcium sulphate in the brine (from rock salt or evaporated salt) can be tolerated in the Mathieson process, thus avoiding the necessity for removal with barium carbonate; it requires only 60 per cent of the floor space needed for the European horizontal cell; the anode construction of the Mathieson cell gives a lower energy consumption by about 15 per cent at equal current densities.

Little Maintenance

The rates of flow of brine, amalgam and water are regulated to produce a 50 per cent caustic solution in the decomposer. Very little maintenance is required.

Present recommendations are for a current density of 2.5 amperes per square inch; current efficiency is credited at 95 per cent. The amalgam can be kept free of impurities by skimming its surface. The electrolyser is provided with an end box, having a removal cover for this purpose.

Aluminium Production in Norway

The first part of the large State-owned Ardal aluminium works, with an annual capacity of 12,000 tons of aluminium, is expected to be in operation by the beginning of next year. The works are to be the largest in Norway and will have a total capacity of 24,000 tons, thus increasing the country's total productive capacity to about 50,000 tons. A large part of this output will be shipped to world markets.

Celluloid Dolls from Germany Again.—The Rhenish Rubber & Celluloid Works at Mannheim-Neckarau have received export orders totalling $500,000. Sweden and Switzerland have ordered $300,000 worth of dolls and first deliveries will be made soon. Contracts with Belgian and Dutch firms provide for exports valued at $200,000. Licences have yet to be granted. The firm of Meise & Möcking A.G. at Wuppertal, British Zone, manufactures scales, lids, boxes and cases from celluloid and "Cellon." It specialises in containers and lids for the chemical and pharmaceutical trades.

THE COMMERCIAL SEPARATION OF ISOTOPES

by FRANK RUMFORD, Ph.D., F.R.I.C., M.I.Chem.E.

MOST chemical elements are known to consist of mixtures of isotopes, or atoms of varying atomic weight, but identical, or nearly identical, chemical behaviour. Isotopes owe their existence to variations in the weight of the atomic nucleus, with a constant nuclear charge and constant arrangement of electrons in the outer atomic structure.

Until recently, the commercial importance of individual isotopes has been small, but since the development of atomic energy the situation has changed completely. The isolation of U^{235} and the preparation of heavy water were vital stages in the early work, as described[1] in the Smyth Report, and may still play an important part in power generation by atomic piles.

Again, the new elements appearing as a result of atomic disintegration may be isotope mixtures of which one member is of outstanding importance. In these circumstances, it seems certain that isotope separation on a commercial scale will be widely practised in the immediate future.

Varying Methods

A number of established methods of separation may be used, depending on (a) different atomic mass; and (b) different physical or chemical properties.

If for any mixture of isotopes a single process of separation is carried out, then the "separation factor" R, for any one component may be defined as the ratio of concentration of that component before the operation to the concentration afterwards. It is often convenient to use for such operations the term "enrichment factor" E, defined as $(R-1)$. In a typical process, that of gaseous diffusion, the rate of diffusion is proportional to the square root of the gas density and for two isotopes of mass D_1 and D_2 the ideal value for R would be $\sqrt{\frac{D_1}{D_2}}$. This rate would only obtain for the first traces of gas passing the diffusion membrane, and for a process in which half the total amount of gas diffuses, the actual enrichment factor will be only 0.69 $(R-1)$, where R has the ideal value given above.[2] Clearly the lower the enrichment factor, the greater the number of stages required in order to bring about a given degree of separation.

Considering the system in which a mixture of two gases, of molecular masses M_1 and M_2, are separated from another space at lower pressure by a porous diaphragm, it follows from the kinetic theory that the mean molecular velocities V_1 and V_2 are to each other in the ratio of the square roots of the molecular masses, or the molecules of the lighter gas M_1 will strike the barrier at a rate $\sqrt{\frac{M_1}{M_2}}$ times as fast as the heavier molecules, provided that equal numbers of each gas are present in the original mixture.

The ideal porous diaphragm would pass all molecules striking it, but would contain no passages large enough to admit of mass flow of several molecules at a rate proportional to the average density of the gas mixture. This condition requires that the barrier should contain no holes larger than about one-tenth of the mean free path of the gas molecules. At atmospheric pressure, this path is one of the order of 0.1 microns, so that the barrier holes should be of the dimensions corresponding to 0.01 microns.

To increase the allowable size of aperture, it would be necessary to reduce the total gas pressure, while an increase in the pressure in an endeavour to increase throughput will only make the diaphragm less selective. For maximum throughput, the holes should be as numerous as possible, and should not clog up—the gases must be dust free—or corrode in any way. If the simplest arrangement of pressures is required, then one side, preferably the high pressure side, of the diaphram must be maintained at atmospheric pressure, and the apparatus must be strong enough to withstand pressures of the order of one atmosphere.

Many Stages of Separation

As the enrichment factor when dealing with isotopes will usually be small, the separation will need a number of stages, with the stream enriched in one component passing counter-current to the stream enriched in the other. Where one half of the total gas present in each stage passes through the membrane, which would appear to be the most suitable arrangement, the enrichment factor for two gases of masses D_1 and D_2 will be $0.69\left(\sqrt{\frac{D_1}{D_2}}-1\right)$ where D_2 is the lighter molecule. In the classic case of the separation of the uranium isotopes in the form of the hexafluorides,

the relative masses were as 352 to 349, and the value of the enrichment factor 0.003. In ordinary uranium, the concentration of U^{235} is 0.7 per cent, which suggests that at least 1650 stages will be required in order to obtain a product of 99 per cent purity.

These stages will be arranged somewhat on the lines of Fig. 1. Here R_1, R_2, R_3—represent successive stages, with the gases passing the diaphragms d_1, d_2, d_3—being boosted by the pumps P_1, P_2, P_3—while mixing with the "reflux" gas stream from the stage in front. Where such a large change in concentration is required it will be necessary to handle large quantities of the original mixture in order to give any reasonable amounts of the more concentrated gas. The size of the stages necessary when only the U^{235} is required will become steadily less, and the system may be compared with a series of fractionating columns working on almost total reflux, with the relatively small quantity of product from each column forming the feed for the next in series.

A Typical Example

No data are available for the quantities actually circulated in the actual plants, or for the rate of flow through the diaphragms, although the operation was on a very large scale.[3] It is of interest to speculate on the much simpler case of the separation of deuterium from ordinary hydrogen. Here the ideal separation factor is $\sqrt{2}$ and the enrichment factor for a 50 per cent gas passage 0.286, which suggests some 35 stages, in passing from 0.02 per cent up to 99 per cent of deuterium. For an output of 1 lb. mol. or 4 lb. of deuterium per day, the amount of gas to be handled in the first stages will be 75,000 cu. ft. per hour, and nearly the same volume will pass through the diaphragm in the first stages, following the flow lines of Fig. 1.

If an arbitrary flow rate of 1 cu. ft. per

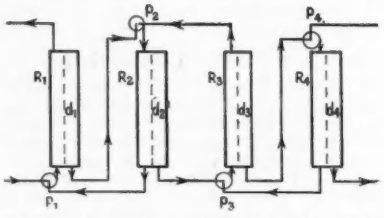


Fig. 1. Arrangement of diffusion stages

minute per sq. ft. of diaphragm is assumed, then the total diaphragm area in this stage will be 1250 sq. ft. The area required in later stages will be much smaller, but, assuming a mean value for all stages of 625 sq. ft., a total diaphragm area of 22,000 sq. ft. will be required. If it be further assumed that a pressure drop of 7 lb./sq. in. is incurred in passing the barrier of the first stage, then the power consumption will be about 50 kWh, and a total power requirement of the order of 2000 kWh may be expected.

It will be seen that this, the simplest of all isotope separations, still involves a great deal of plant and power. Nevertheless, a diffusion plant of this kind was used for the separation of the uranium isotopes, even though as low a figure as 0.0014 has been quoted for the enrichment factor actually obtained. It is unfortunate that the hexafluorides are the only readily available gaseous compounds of uranium, as they are chemically reactive and rapidly attacked by water.

The nature of the diaphragm is not known, and any comments are pure speculation, although Smyth mentions an etched silver-zinc sheet. If porous earthenware diaphragms are used, of considerably smaller pore size than the normal commercial types, then they could most easily be assembled as tubes in headers, as shown in the purely speculative form of Fig. 2. The necessity for absolute vacuum tightness in the plant was apparently met by building with such materials as pyrex glass fused together at joints.

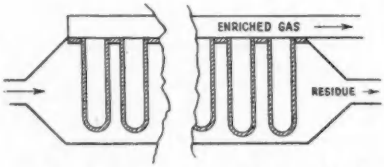


Fig. 2. Diffusion unit: suggested design

Alternative Method

An interesting variation on standard diffusion methods which may be of use in the future introduces a third component, such as steam, with only a light membrane through which all components may pass. Then the two compartments of the diffusion cell are maintained at the same pressure, but one is filled entirely by steam in the initial stages. Then the two isotopes will diffuse into the steam-filled cell at different rates, though these will differ less than with the simple fine pore barrier. The only advantage over ordinary diffusion is that the special diaphragm is dispensed with. G. Hertz carried this method to its logical conclusion and used mercury vapour in a diffusion pump as a "membrane" into which diffusion occurred, but the method demands very high vacuum and is hardly likely to be useful in this form.

This phenomenon, caused by convection

currents in fluids, tends to concentrate groups of molecules of greater or lesser weight in certain zones of the system. Thus, when a hot wire is stretched in the centre of a gas-filled tube, the lighter molecules tend to concentrate at the top of the tube. In the classic experiments of Clusius and Dickel[4] an arrangement of five tubes in series, with a central platinum wire in each heated to 600°C., gave a "heavy" hydrogen chloride containing 99 per cent of HCl^{37} and a light product containing 96 per cent of HCl^{35}. The energy requirements were very high—of the order of 10^4 kWh per gram of isotope separated.

The method is applicable to liquids and the plant is very simple at first sight, consisting only of three concentric tubes, with steam in the innermost, water in the outermost, and a thin liquid annulus in between. These may be erected in stages as for gaseous diffusion, and should demand much less power for pumping and make up to a much more

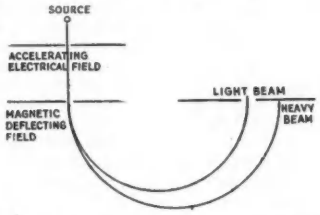


Fig. 3. The effect of the magnetic field on the molecule stream

compact plant. It has been found, however, that the central tubes must be very accurately centred, while the rate of production is very small compared with the amounts of steam required.

As the liquid thermal diffusion plant reduces to a series of fairly efficient condensers, the high steam usage is not surprising, and it seems that gaseous thermal diffusion is much more economical, even though the compactness of the plant disappears. Thus, for a plant to separate 100 grams of C^{13} per day, in concentration of 90 per cent, from natural methane, it is suggested by Benedict[5] that a hot surface of 26,000 sq. m. and a heat input of 7500 kWh will be required. The surface will be divided into about 9000 columns of 6 in. in diameter and 20 ft. high.

Electro-Magnetic Separation

This may be termed the classic method of isolating isotopes. As will be remembered, it is based upon the mass spectrograph, in which a narrow stream of ionised molecules is accelerated to a high kinetic energy and then bent by a magnetic field in a curve, the radius of which is determined by the masses of individual molecules (Fig. 3).

Unfortunately the individual ionised molecules represent a very small yield for the plant and energy employed. The process demands high vacua, high voltages, and intense magnetic fields; it is necessary to separate isotopes bearing a single electron charge, and heavier charges represent wastage, while the entry slots are narrow, and any attempt at widening means a lower separation factor. In the projects for the separation of uranium isotopes enormous magnets—cyclotron units—were used, but it is doubtful if these could be contemplated in more normal practice.

A possible development which may overcome some of these disadvantages is described by Smyth. A supply of ionised molecules from a wide slit is accelerated as before and then exposed to a further electrical field varying at radio frequency. This causes "bunching" of the ions in clusters, and each of these clusters divides into a light and heavy group travelling at different speeds. Then, at a suitable point in the path, groups of light isotope arrive first, followed by a heavy group. A further synchronised electric field can then be set to deflect each alternate cluster.

The scheme is claimed to work in the separation of lithium isotopes, and would avoid the use of the enormous magnets, although high vacua and complicated electric fields are still called for. The wider beam of charged molecules would give a higher throughput than in the standard mass spectrograph. Despite these advantages, it is doubtful if such a process will ever be used in the bulk production—up to pounds in weight—of typical isotopes.

Centrifugal Processes

Under the influence of very high centrifugal effects—up to 200,000 times the force of gravity—mixtures of light and heavy molecules in fluids tend to separate into light and heavy fluid layers. The separation is proportional to a function of the difference be-

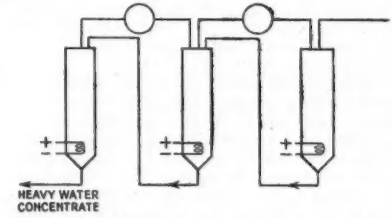


Fig. 4. Heavy water concentration. Electrolytic-chemical exchange

tween the molecular weights, instead of the more usual function based upon the ratio of the respective weights. This makes the centrifugal method more attractive for the

separation of isotopes of high atomic weight, as will be seen by comparing the separation factors for carbon and uranium isotopes. By diffusion, the relative factors are $\sqrt{\left[\frac{13}{12}\right]}$ and $\sqrt{\frac{238}{235}}$, or 1.04 and 1.007; by centrifuging the factors are a function of 1 and 3 respectively.

A gas centrifuge system for heavy molecules presents a notable advantage, therefore, but it will be appreciated that the very high centrifugal effects required make construction difficult and power consumption very high. Little has been published on this type of plant but Beams and Skarstrom[6] have described a concentric tube centrifuge with an outer radius of 4 in., some 11 in. long, giving a centrifugal force of 170,000 g. This, for carbon isotopes, gave an enrichment of 0.0195, while to produce some 100 grams a day of 90 per cent purity C^{13} would require about 19,000 centrifugal stages[6]. Power requirements would be very large, as it is estimated that each centrifuge would require 1 h.p., or perhaps 20 kWh per day, to drive it.

If it were possible to design larger centrifuges with the same centrifugal effect, and these were so designed as to diminish frictional losses to a marked extent—two very difficult problems—then centrifugal separation might become a process comparable with diffusion or chemical exchange.

Chemical Exchange

All chemical differences must be small, by the definition of an isotope, but, nevertheless, they exist and, as would be expected, are most marked with hydrogen and deuterium. Thus, when water is being decomposed by electrolysis, the residue grows steadily richer in heavy water. This may be due to several reasons, such as ionic discharge rates, or to the important exchange reaction: $H_2O + HD = HDO + H_2$, in which the normal equilibrium leaves between three and four times as much deuterium in the liquid as in the gas phase.

Whatever this may be, it has been found possible to increase the concentration of heavy water up to 90 per cent by a decomposition of water amounting to a volume decrease of 100,000, *i.e.*, 1 ml. of water from 100 litres. In commercial production, this process is improved by working in stages as in Fig. 4, and washing the products of electrolysis with water from the previous stage. As with diffusion, the stages are largest at the water feed end and smallest at the D_2O end, while catalysts have been used to increase the rate of exchange.

Such a system lends itself to thermal economy, and the use of hydrogen as fuel for power units, and it should be possible to cut down very considerably, the large amounts of power required by " straight " electrolysis.

This chemical exchange between liquid and gas is typical of other isotope separations, and has been used to concentrate the heavy forms of carbon, nitrogen and sulphur. Thus, if when HCN gas flows counter current to sodium cyanide solution, the vapour becomes enriched in heavy carbon—C^{13}. At the bottom of the column, the sodium cyanide is decomposed by sulphuric acid to regenerate HCN gas, while at the top the gas is absorbed in caustic soda solution. Small proportions of both top and bottom products are drawn off to give concentrate and denuded fractions, and these pass to the next tower of the series, up or down according to the normal countercurrent system.

The ratio of C^{13} in the gas to liquid concentrations appears to be about 0.987. For nitrogen and sulphur, the systems are ammonia-ammonium nitrate, and sulphur dioxide-sodium bisulphite, respectively. The number of mols. of material flowing per mol. of heavy isotope varies from 2000 to 10,000. In terms of distillation practice, this would correspond to a " reflux ratio " of from 2000-10,000 to one, but the simple heat input is replaced by chemical input, in the form of sulphuric acid and caustic soda or similar reagents. These are much more costly than heat, and can probably only be justified when a high enrichment factor can be obtained.

As this is essentially caused by chemical differences, and as these, by definition, are small, it is not likely that chemical exchanges will prove very popular. As a rule the size of the column in which chemical exchange occurs is determined by the normal rules for mass exchange between liquid and gas, and the column will be equivalent to the same number of transfer units or theoretical plates as in distillation or gas scrubbing.

Certain differences in chemical behaviour have been noted[5] in the interaction of alkaline earth salts and zeolites. These bodies, working on a base exchange cycle, are widely used in water softening, and they appear to have some separating effect with isotopes of nitrogen, lithium, and potassium. It is probable that a number of other small chemical differences remain to be discovered, but whether they will be any more effective than the liquid-gas equilibria is doubtful.

Difference in Vapour Pressure

The technique of dealing with small differences in vapour pressure has long been established in industry, and fractional distillation, with multiplate fractionating columns, working on high reflux, are

(*Continued on page* 238)

Patent Law in the U.S.S.R.

Sweeping Powers for Government Committee

THE extraordinary disparity between patent law in Russia and in the Western World is underlined by the reappointment with wider powers of the Soviet Committee for Inventions and discoveries.

The present patent law in Russia was promulgated by decree of March 5, 1941. The committee reappointed to administer it has to take the initiative in and accelerate general development of new inventions; to maintain close liaison with the various ministries and departments through whom inventions and discoveries come to light, and control the activities of these departments in regard to inventions. The last includes the applications of new patents to industry, financial and other assistance to inventors, ensuring secrecy, remedying complaints or abuses; and granting patents and authors' copyrights.

Although there is, under existing Soviet law, an Inventions or Patent Office, its duties would appear to come largely under the control of the new committee which apparently has the power to grant patents and certificates, as well as to afford assistance to inventors in the form of both legal and technical advice.

Chemical Products Barred

The Russian patent law of 1941 deals with inventions, technical improvements, and rationalisation proposals or suggestions from factory workers. Under these various categories either patents or authors' certicates may be granted. Patents may not be issued for chemically obtained products but only for methods, both chemical and non-chemical. Authors' certificates are granted for medical, gustatory, and food products prepared by other than chemical means. An inventor may request either recognition of his invention, in which case an author's certificate is issued; or exclusive rights therein, for which a patent would be granted. A clause is included whereby patents or certificates can be given only for inventions that can be used industrially. (This term must be interpreted widely.) Where certificates are granted the invention belongs to the State which undertakes development, but the inventor receives some remuneration. Certificates only are granted in respect to inventions arising out of the innovators' daily work in laboratories or State institutions.

The various State organisations through whom inventions applications may be lodged are bound by law to prepare special estimates of costs and remuneration, preparation of models, maintaining experimental stations, tests and so forth.

The term or life of a patent is 15 years from date of application. Persons or corporate bodies using an invention in the U.S.S.R., or who had made preparations to do so, independently of the inventor, may continue to do so, under certain conditions; and a patent may apparently still be granted to the inventor, despite this prior user. Special agreements are made with inventors in regard to patents of State interest, and failure to agree may result in compulsory licensing. Applications for patents and certificates are published in the *Inventions Bulletin* and are subject to objection within three months. *The Bulletin* is published by the office which also undertakes international exchange of patent materials.

The amendment of November, 1942, contains further rules as to remuneration for suggestions made in factories, by directors, managers and workpeople, including calculations as to estimated savings effected by such improvements or rationalisation proposals. Distinction is made in this case between technical and organisational suggestions.

Official Notice

Quinine Control Ended

QUININE and quinine salts and other cinchona bark products are in very satisfactory supply, states a Board of Trade announcement, and there is no longer need to continue control over their supply in this country. An order revoking this control (from July 27) has been made. For the time being, export control will be retained on quinine, quinidine, cinchona and other salts. This is to ensure that the relatively small quantities of these drugs needed for essential purposes are available in the unlikely event of a future shortage.

The Order concerned is S. R. & O., No. 1553 of 1947, entitled the control of Cinchona and Cinchona Products and Synthetic Substitutes (No. 3) Revocation Order, 1947. (H.M.S.O., 1d.)

Seaweed and Vegetable Oils

The Eire Research Council in their report for 1945-46 deal with investigations into the chemical composition and the industrial possibilities of seaweed. With a view to ascertaining the possibility of increasing the output of certain seaweeds, particularly the laminarians, an investigation was commenced during the year as an extension of the survey of marine algae into the factors affecting growth.

"The question of carrying out investigation into the production of oil from Irish-grown plants has been under consideration for a number of years," says the report.

I.L.O. Industrial Committees

U.K. Metal Representatives

TWO of the seven international committees set up by the governing body of the International Labour Office to deal with conditions in major industries will hold their second sessions shortly. The Iron and Steel Committee will meet on August 20, and the Metal Trades Committee on September 2; both meetings will be held in the Parliament Building, Stockholm.

The following have been nominated to attend these meetings as representatives and advisers from the United Kingdom:

Iron and Steel Committee

Mr. S. G. Holloway, assistant secretary, Ministry of Labour and National Service; Mr. T. Stanes, assistant secretary, Ministry of Supply (Iron and Steel Board); Colonel J. M. Bevan, chairman, Briton Ferry Steel Co., Ltd.; Mr. R. Mather, chairman, Skinningrove Iron Co., Ltd.; Mr. R. Ross, president, Iron and Steel Trades Employers' Association; Sir Lewis Jones, secretary, South Wales Siemens Association; Mr. Ambrose Callighan, member of the General Council of the Trades Union Congress; general secretary of the National Union of Blastfurnacemen, Ore Miners, Coke Workers and Kindred Trades; and Mr. Lincoln Evans, member of the General Council of the Trades Union Congress; general secretary of the Iron and Steel Trades Confederation.

Metal Trade Committee

Mr. M. D. Tennant, assistant secretary, Ministry of Labour and National Service; Mr. W. K. Ward, principal, Ministry of Supply; Mr. R. R. Bowman, Permanent Secretary, Ministry of Labour and National Insurance, Government of Northern Ireland, will accompany the Government representatives; Mr. A. Collie Low, secretary, Engineering and Allied Employers' Federation; Mr. W. Watson, secretary, Shipbuilding Employers' Federation; Mr. Robert Openshaw, member of the executive council of the Amalgamated Engineering Union; and Mr. T. McKinney, president, United Society of Boilermakers and Iron and Steel Shipbuilders.

Home Office and Nitrate Risks

The probability that an interdepartmental committee will be set up "to consider the risks accompanied with the movement of ammonium nitrate" is forecast by the Explosives Department of the Home Office.

U.S. Conserving Scrap

Heavier Charges of Iron Ore

IN order to maintain steelmaking operations at the highest level in spite of shortages and deteriorating quality of iron and steel scrap, operating men of the steel industry have devised means of using more iron ore in the open hearth process, according to the American Iron and Steel Institute. Only enough iron ore was normally charged into the open hearth to promote chemical reactions, the amount of ore varying according to the quality and grade of steel being made. The quantity of iron recovered from such use of ore was always looked upon as incidental and unimportant.

Now, however, additional quantities of ore are charged into the furnace in order to recover the iron content. Up to 13 per cent of the weight of purchased scrap has been replaced by the iron derived from iron ore. In using iron ore in this fashion, high-grade lump ore is necessary and about one pound of coke must be charged for every three pounds of ore in order to promote the necessary chemical reactions. Because of the additional quantity of cold materials charged into the furnaces the time necessary to manufacture a heat of steel is increased by about 4 per cent. Operations otherwise are normal.

The shortages of scrap have forced some steel companies to use larger proportions of molten pig iron (often as much as 70 per cent of the total charge) at certain times in recent months. Under normal operating conditions about half of the charge is hot metal and the balance is scrap.

Meanwhile, high operating rates of the industry's blast furnaces have resulted in maintenance of a good volume of shipments of iron to non-integrated steel producers and to foundries. In January, 1947, the 90.8 per cent blast furnace operating rate equivalent to 5,014,796 net tons of pig iron, was accompanied by merchant iron shipments of 671,257 net tons. The latter total was larger than shipments in any month of 1946, and the monthly average in all years since 1929, except in two war years, 1942 and 1943.

Tar Manufacture in Eastern Germany.—The Büscher & Hoffmann A.G. at Halle/Saale—one of the industrial plants transferred lately to the ownership of the provincial Government of Saxony-Anhalt—has resumed the manufacture of tar and bituminous products as well as protective materials for the building trade. When adequately supplied with raw materials, the firm is able to produce 250,000 sq.m. of roofing-felt a month. Output during the first six months of 1946 amounted to nearly 1,000,000 sq.m.

COMPANY MEETING

Benn Brothers, Ltd.

Paper Control and the Trade Press

THE fifty-first annual general meeting of Benn Brothers, Ltd. (proprietors of THE CHEMICAL AGE) was held at Bouverie House, Fleet Street, London, E.C.4, on Friday, August 8, with Mr. Glanvill Benn, chairman, presiding.

Moving that the published report and accounts for the year ended June 30, 1947, be accepted and approved, and that the dividends as announced be paid on August 15, Mr. Benn said: "It is the natural history of publications, as with all other forms of life, to be born, to live and eventually, like old soldiers to fade away. Since 1939, however, an amateur magician, known as the Paper Controller, has attempted to arrest the processes of nature.

Artificial Conditions

"The effect of his orders and regulations has been to freeze the publishing industry at below its 1939 level. In consequence many a periodical which ought long since to have died, continues in the absence of normal competition to exist, while, on the other hand, many a new journal which ought to be serving new aspects of industry remains still unborn—because you cannot establish a worthwhile journal with the statutory ration of 8 cwt. of paper. And, perhaps more important of all, many a vigorous, well-established journal, which ought to expanding rapidly, remains stunted, unable to accept new readers or to accommodate new advertisers.

"The Benn Brothers journals are in this latter category. *The British Trade Journal* is now 84 years old and wholly concentrated as it is on the development of our export trade, is allowed some strictly regulated growth. But for the Paper Controller that growth would be a good deal more rapid. *The Hardware Trade Journal*, not allowed to expand itself, has produced a Register of Merchant Shippers exporting hardware to all the countries of the world which has proved invaluable to traders.

"In mentioning these particular journals I do not wish to imply any invidious distinctions. Without exception all the Benn journals are healthier and more vigorous than ever, and would be growing more rapidly if only we were allowed more paper. But it is not only our journals that are affected; every branch of trade and industry is concerned. Thousands engaged in the productive industries of the country are being starved of the opportunity of obtaining the vital information they need, week by week, at the very time when the Government itself is calling for more production from all sections of industry.

"The industries we serve are themselves all short of raw materials, hence the scarcity of goods in the shops and the much discussed austerity. The shortage of paper, the raw material of our industry, means shortage of news and information. Austerity for the body is bad enough, but atrophy of the mind is far more serious.

"For eight years and more supply has notably outstripped demand in one field of activity only—that is in the manufacture of governmental orders, regulations and controls. The Bank of England and coal have been nationalised, and gas, electricity and transport are in a state of suspended animation awaiting the dead hand of State control. The result of this misplaced manpower, brains and energy, to say nothing of wasted paper, is that to-day the individual workman who does odd repair jobs is better paid than the builder of houses: the farmer gets a better price by selling his grain on the grey market as chicken feed than at the official rate to the miller.

"There is, perhaps, some glimmer of hope. Already our planners appear to be beginning to realise that the restoration of incentives is essential if folk are to work with a good heart. Our present rulers have not yet had the courage to confess the error of the doctrines they have preached for so long, but if they are now willing to admit that incentives are necessary, it may not be long before they recant their former heresies and preach the virtues of the profit motive and the continual democratic plebiscite which a free market involves."

The Wider View

Sir Ernest Benn, Bt., seconding the resolution, said the year under review had seen more foreign travel by members of the board of directors than any year in the company's history. He welcomed the new trend and hoped that the practice would be developed, and perhaps extended to some of the senior editors and managers. It is very important that people like ourselves should go abroad and imbibe information and inspiration from a wider view of affairs, not only because of the interests of this company, but because from a national point of view we must once again resume our natural position as the nerve centre of world trade and commerce.

The resolution was carried unanimously.

The re-election of Mr. K. E. Hughes as a director of the company was moved by Miss E. Bartlett, seconded by Mr. A. J. Knivett and carried unanimously.

A vote of thanks to the staff was carried on the proposal of Mr. John Benn to which Mr. Walter Vestey replied.

COMMERCIAL SEPARATION OF ISOTOPES

(*Continued from page* 234)

common. However, the separation of isotopes may present a most difficult problem. It may be calculated that a column of more than 200 plates, working with a reflux ratio of 1000 to 1, will be required to increase the concentration of D_2O from 0.02 per cent up to 1 per cent, and a further column of the same height and operating characteristics to raise this to 99 per cent. It would thus be necessary to boil up at least 60,000 pounds of water in order to remove one pound of concentrate from the base of either column, giving a minimum total consumption of 120,000 pounds of steam per pound of heavy water produced. These quantities might be reduced by the aid of special recompression units, or by utilising the methods of multiple effect evaporation, but remain a very substantial charge, and this for the simplest isotope separation. The columns would be very long; it is doubtful if any commercial columns of more than fifty theoretical plates are being operated as single units, although certain laboratory columns have been devised to give very high plate numbers in a comparatively small height. Thus, Dostroovsky and Hughes[3] describe a packed column 12 feet long and an inch or so in diameter, equivalent to some 450 plates when working on this problem of heavy water.

Distillation appears to be an economic method of obtaining heavy water, but the low separation factors indicated for other isotopes have so far proved a barrier to wider exploitation. It may be noted that distillation effects in the chemical exchange system for deuterium aid in the concentration of D_2O at the base of the column.

In ordinary distillation, it has often proved possible to accentuate differences in vapour pressure by the addition of another component—azeotropic or extractive distillation—but there is no evidence that these methods have proved successful in the case of isotopes. As they depend upon chemical differences between the two original components, this is not surprising. As a general rule, differences in vapour pressure increase as the total pressure is lowered and this would suggest that the methods of " molecular distillation " may be applied to isotope separation. So far, however, no satisfactory methods for operation in stages—fractional molecular distillation—have been devised. The standard spinning disc system is complicated enough without being used on the scale required in a cascade.

Summary

The actual processes that have been operated for separation of isotopes in amounts of the order of gram molecules and upwards are those of chemical exchange, thermal diffusion, gaseous diffusion and distillation (only in the case of deuterium). To these may be added, perhaps, the gas centrifuge system. A comparison between the four more universal systems has been given by Benedict[5], and is set out in Table 1.

In view of the very large amounts of plant required, it appears that the ideal process has not yet been hit upon. Perhaps a development of distillation, or the preparation of a greatly improved diaphragm for gaseous diffusion may enable considerable economies to be made. The problem is a fascinating one for chemical engineers and it is probable that much attention will be paid to it in the immediate future.

REFERENCES

[1] *Atomic Energy. H.M.S.O. and U.S. Government Report*, 1945.
[2] *Loc. cit., p.* 104.
[3] See, e.g. *Chem Eng.*, 1945, Dec., 98; 1946, Feb. 112.
[4] *Naturwiss*, 1938, 26, 546. 1939, 27, 645.
[5] *Trans. Amer. Inst. Chem. Eng.*, 1947, 43, 41.
[6] *Phys. Rev.*, 1939, 56, 266.
[7] Urey et al, *J. Chem. Phys.*, 1940, 8, 532.
[8] Urey, *Ind. Eng. Chem.*, 1937, 29, 531.
[9] *Nature*, 1946, 158, 164.

TABLE 1
For the preparation of 100 gms. of C^{13} per day

Process	Enrichment Factor	Stages or Plant	Energy or Chemical Requirements
Chemical Exchange	0.013	1000 plates	2 tons NaOH 3 tons H_2SO_4
Thermal Diffusion	0.0051	{ 9000 columns 2600 sq. m.	7560 kWh.
Gaseous Diffusion	0.043	345 stages	149 kWh.
Gas Centrifuge	0.0195	19000 centrifuges	

All figures are based on minimum requirements for production of 90 per cent. pure product, in a 50 per cent. yield from natural carbon compounds.

Austrian Oil Cracking Process

The only up-to-date cracking plant in Austria, at Schwechat near Vienna, at present obtains 25 per cent of petrol from the oil of the Zistersdorf Reservoir. This process leaves a considerable waste that can be used only as inferior fuel oil. Gustav Kroll, an Austrian chemist, has now developed an electrocatalytic cracking process which can not only be employed much more economically and efficiently than the high-pressure method at present in use, but may possibly permit as much as 40 per cent petrol, 25 per cent paraffin oil and 20 per cent diesel oil to be obtained.

CHEMICALS IN SOUTH AFRICA

For the first time, the Price Controller has fixed maximum prices of boot, shoe, and floor polishes. The increased prices are due to the higher prices of raw materials and packing. Maximum prices of lead-acid type batteries manufactured in the Union have been fixed at from £5 3s. to £10 3s. each.

* * *

Mossel Bay, one of the world's largest exporters of extract of aloes, is at the height of the tapping season, which is shortly before the plants are in full bloom. The spiny leaves are cut and stacked in piles in the open in such a way that the thick yellow oil from the veins flows into skins arranged in hollows in the ground. The extract is subsequently distilled to concentrate the extract which then becomes a solid resin-like mass ranging from dark brown to almost black in colour.

* * *

The establishment of a new factory in Durban for the manufacture of industrial paint and varnish products not at present made in South Africa with possibly another factory at Port Elizabeth to meet the special requirements of the motor industry, and other expansion in various centres of the Union to follow, is to come about as the result of important agreements between Herbert Evans & Co., Ltd., and Pinchin, Johnson & Co., Ltd., of London.

* * *

The latest production statistics recently issued by the Department of Mines, and relating to base minerals in 1946, show a decrease in coal and asbestos, but substantial increases in manganese and chrome. The following figures in short tons compare with output in the previous year (in brackets), coal 26,016,307 (25,964,285); asbestos 20.225 (28,216); manganese 262,238 (126,266); chrome 233,970 (109,299). The value of exports of chrome increased from £424,000 to £608,000, copper from £1,302,000 to £1,692,000 and manganese from £389,006 to £905,000.

U.K. Light Metals Statistics

Production in May (long tons) was:—

Aluminium Production: Virgin and secondary ingot (together) 7748.

Aluminium Scrap Arisings: Arisings, arisings percentage segregated, and consumption (together) 20,393.

Aluminium Fabrication: Sheet and strip, foil, extrusions, castings, and forgings (together) 16,986.

Magnesium Fabrication: Sheet, extrusions, castings, and forgings (together) 178.

POPULAR GREEN

When 1000 people were offered a choice of soaps in a wide variety of colours, 70 per cent chose green. So that is the colour of a new fatless coupon-free synthetic household tablet shortly to appear in the shops. The Ministry of Food has granted a manufacturing licence to a soap research firm, and an early output of half a million tablets a week is the target. Mr. Edward Shamash, chemist, who developed the product, states: "The substitute's cleansing efficiency is four times greater than that of ordinary soap, and it lathers better." A soluble plastic which binds the ingredients together is said to be one of the secrets of the new soap.

Lloyd's Class 1 Certificate

Whessoe, Ltd., manufacturers of welded pressure vessels for liquid and gas storage, advise that their name has been placed on the list of recognised manufacturers of that type of equipment by Lloyd's Register of Shipping, and a Class I Certificate has been granted to that effect.

It is a significant fact that there are in the entire world only about two dozen firms so recognised by Lloyd's. That half of them are British pays tribute to the high standard of engineering technique and workmanship achieved in this country.

Misnomer

Although the Dyestuffs Division, I.C.I., is a designation familiar to all associated with chemical industry, the title is a misnomer. Only about 60 per cent of the division's output today is of dyestuffs. Almost as important in the seven factories with their 10,000 employees are now such products as rubber chemicals, synthetic rubber, synthetic resins and pest control products. This fact is made clear in "The Story of the Dyestuffs Division," published in the July issue of the *I.C.I. Magazine*, in which another interesting contribution is made by Sir Wallace Akers of the possible uses of atomic power.

Lead Shortage and High Prices

In the course of his address at the 16th annual general meeting of Goodlass Wall & Lead Industries, Ltd., Mr. Clive Cookson, the chairman, stated that there is an acute world shortage of lead, and that no new deposits of any size have been discovered in recent years. With regard to the prevailing high prices, Mr. Cookson took the view that their immediate effect might be to bring forward supplies that might otherwise not emerge, although in the long run, lead, compared with the other nonferrous metals might be relatively higher in price than in the past.

Home News Items

Philips Lamps Changes Name.—On September 1, 1947, Philips Lamps, Ltd., will change its name to "Philips Electrical Limited."

Change of Address.—The Head Office of New Metals & Chemicals, Ltd., have been moved to larger premises at 16 Northumberland Avenue, London, W.C.2, with adjoining warehouse at Craven Street. The new telephone number is Whitehall 0573.

Unwanted Chemicals. More than 10,000 tons of chemical warfare materials, regarded as unsuitable, or too dangerous, to be recovered for industrial use, were aboard the dismantled *Leighton* sunk last week in the Atlantic, 160 miles from Cairnryan, Scotland.

Clay Convention, 1947.—The Eighth Clay Convention, organised by the National Federation of Clay Industries and the British Ceramic Society, will be held at Scarborough from September 22 to 27 under the presidency of Mr. J. G. Johnston, president of the National Federation of Clay Industries.

Anglo-Jugoslav Trade Talks.—A trade mission from Jugoslavia is understood to be coming to this country shortly for the purpose of discussing extensive trading. It is suggested that the party will include M. Melentije Popovic (Foreign Trade Minister) and M. Stanislav Kopcok (Deputy Minister of Industry).

Industrial Safeguards.—M. R. E. Tugman, of Imperial Chemical Industries, Ltd., will provide one of the two papers on safety methods in American industry, which will form part of the Silver Jubilee Congress at Brighton of the Royal Society for the Prevention of Accidents, October 7-10. Mr. Tugman has recently been studying his subject in the U.S.A.

Steel Nationalisation Forecast.—Speaking at a trade union meeting in Motherwell, Mr. Alexander Anderson, Socialist M.P. for Motherwell, said that the iron and steel industry would definitely be nationalised and that the Bill was in draft form. In Scotland modernisation and centralisation of the existing plants were likely to take place in conjunction with new developments.

New Branch.—J. W. Towers & Co., Ltd., manufacturers of chemicals, laboratory and scientific equipment, announce that a new branch will be opened at 28 Bridge Road, Stockton-on-Tees, on September 1.

Rising Chemical Prices.—Wholesale prices of chemicals and oils were 18.6 per cent higher last July than in July a year ago. Comparison with 1938 wholesale prices shows an increase of 85.1 per cent—states the *Board of Trade Journal*.

Pitch and Tar Infections.—The number of industrial diseases reported in June under the Factories Act, or under the Lead Paint Act, amounted to 44. Twenty-nine of these cases were diagnosed as epitheliomatous ulceration (skin cancer), 28 being directly attributable to pitch (16) and tar (12).

World Need of Insecticides.—Sir John Boyd Orr, of the United Nations Food and Agricultural Organisation, told a conference of scientists in London last week, called by the F.A.O., that there was a good case for recommending Governments to give priority to producers of insecticides. Some 10 per cent of the world's harvests, he estimated, were lost through insects, fungi and rodents.

Steelworkers to Raise Output.—This week saw the introduction of an extended working week, including Sundays, at the cogging and plate mills of the Clydebridge Steel Works, Cambuslang. A works representative of the British Iron and Steel Confederation, stated that the men were meeting the employers' request, so as to produce an adequate supply of stock slabs and to make good tonnage lost in a recent mechanical breakdown.

I.C.C. Resolutions for U.N.O.—The resolutions adopted by the International Chamber of Commerce at its first post-war Congress in Montreux last June were on August 12 officially submitted for consideration in their final published form (I.C.C. brochure 117) to the Economic and Social Council of the United Nations. They were accompanied by a letter from the new president of the I.C.C., Mr. Arthur R. Guinness, to the Hon. Dewan Bahadur Sir Ramaswami Mudaliar, president of the E.S.O.C.

PERSONAL

DR. E. C. SNOW, who was formerly the Leather Controller, has been appointed director of the United Tanners' Federation.

MR. R. E. REED, chairman of A. Elder Reed & Co., Ltd., and a former chairman of the British Chemical and Dyestuffs Traders' Association, left £22,325. He died in March last.

MR. DONALD MCMASTER, formerly deputy chairman of Kodak, Ltd., London, has returned to the U.S. to take up his new duties as vice-president and assistant general manager to the Eastman Kodak Company, Rochester, New York.

MR. D. P. C. NEAVE, managing director of Imperial Smelting Corporation, Ltd., has been elected a director of Fisons, Ltd., in succession to MR. L. B. ROBINSON, who has recently accepted other appointments which will necessitate constant foreign travel.

MR. C. G. H. HALLET has resigned from the board of the Ship Carbon Company of Great Britain.

SIR GEOFFREY K. PETO and MR. C. W. SPIERS have retired from the board of Morgan Crucible Co., Ltd., to which MR. J. WALKER has now been appointed.

Society of Chem. Ind. Appointments

MR. REGINALD GEORGE, who was formerly general sales manager of Bell & Sons, Ltd., Liverpool, is to manage a new plant which Ortho Pharmaceutical Corporation of New Jersey, U.S., is establishing at High Wycombe, Bucks. Mr. George has just returned to this country to assume his new duties after spending several weeks in the United States observing methods and installations in use at the new Ortho plant at Raritan, New Jersey.

MR. S. THOMSON, a director and manager of the Lanarkshire Steel Co., Ltd., and MR. JAMES GIBSON, manager at the Glengarnock Steel Works, have been appointed executive directors of Messrs. Colvilles, Ltd. DR. J. M. FERGUSON has been appointed works manager at the Dalzell Works, and MR. W. GILLIES, works manager, while MR. D. C. WYLIE has become plant manager at the Lanarkshire Steel Works. It has been decided to co-ordinate the management of the Dalzell Works and Lanarkshire Steel Works, and MR. S. THOMSON becomes general manager for both works.

DR L. H. LAMPITT has been re-elected president of the Society for a second year. The following have been elected vice-presidents: MR. H. W. GREEN, and MR. E. M. MYERS. The four vacancies on the council have been filled by the election of MR. M. P. BALFE, MR. E. E. BOAKE, DR. W. H. J. VIRNON, and PROF. E. C. DODDS.

The American Chemical Society has announced that the Francis P. Garvan Medal honouring women in chemistry is to be awarded to PROFESSOR MARY L. SHERRILL, head of the chemistry department at Mount Holyoke College, where she directed the investigations into antimalarial compounds.

Prof. Mary L. Sherrill

Dr. Louis Schmerling

Another A.C.S. award—only recently established and not yet conferred—is the 3000-dollar Ipatieff Prize in Chemistry. This is to be awarded to DR. LOUIS SCHMERLING for his reactions of hydrocarbons.

SIR GEORGE CUNNINGHAM, Governor designate of North-West Frontier Province, Dominion of Pakistan, has resigned from the board of Attock Oil.

Obituary

SIR WILLIAM FOOT MITCHELL, a former M.P., and at one time a director of Shell Transport and Trading Company, has died at the age of 88.

Shackleton Relic

A copper cylinder which had lain in the frozen wastes of McMurdo Sound, Antarctica for more than thirty years, has been found by the U.S. Navy and identified by a message which it contained, as a Shackleton relic. Of immense technical interest to metallurgists everywhere, the cylinder has been sent to the Copper Development Association where it is to be examined. Only on rare occasions does an opportunity present itself for investigating a metal object for so long exposed to the rigours of Antarctic conditions.

The cylinder, which is made from .022 in. sheet or strip copper, is 6 in. long, and has a diameter of 1½ in.; it has a beaded edge at the open end, and a soldered seam down one side and round the bottom. Dr. F. Baker and Dr. E. Voce, the Association's chief chemist and chief metallurgist respectively, are supervising the examination.

Overseas News Items

Copper Mine Strike.—Workers at the Mosaboni mines of Indian Copper Corporation commenced a lightning strike on July 29.

Tanning Materials in Western Germany.—The cellulose factory Waldhof at Bensheim, U.S. Zone, is now producing various tanning materials. The firm is well known for the manufacture of cellulose, paper, yeast, alcohol, caustic soda and charcoal, but has not hitherto turned its attention to tanning materials.

U.S. Tyres and Wheels for Austria.—In order to relieve the existing scarcity of car tyres and wheels in Austria the U.S. occupation authorities have agreed to transfer 9510 used tyres and 600 wheels from U.S. army stocks to the Austrian Government for distribution in the U.S. Zone of occupation only.

Phosphate Discovery in China.—Deposits of phosphate rock, said to be capable of yielding 2,500,000 tons of fertilisers, are reported to have been discovered near Fengtai, Anhwei Province, China. A preliminary analysis by UNRRA chemists is understood to reveal that the rock compares with that used in the U.S.A. for the production of defluorinated tricalcium phosphate fertiliser.

Portent of Nationalisation.—Socialisation of all basic industries, including coal, oil and steel and chemicals, transport and power services, has been decided upon by the Schleswig-Holstein Landtag. Compensation will be paid to all not war criminals or Nazis. Former managers and owners will remain in charge as trustees until the measure "can be ratified on an all-German basis."

Sawdust Cement in Australia.—Sawdust Portland cement as a material for floors of buildings is one of the many innovations which Australia has designed to expedite building progress and to provide substitutes for materials in short supply. Information as to the suitability of sawdust for this purpose has been obtained during the last two years at the Forest Products Division of the Australian Council for Scientific and Industrial Research at Melbourne. Australian mountain ash (*Eucalyptus regnans*) has been found to provide the most successful sawdust. The addition of lime improves the setting qualities of the cement in the presence of sawdust, while calcium chloride has a very definite value as a setting accelerator. Although the introduction of sand results in a more robust and more easily laid mix, it reduces the good insulation properties.

Czech Scrap Metal Collection.—Scrap metal is being collected throughout Czechoslovakia during July and August in order to supply the country's industry with raw materials. Equipment left behind on the battle fields by the retreating German armies is particularly sought.

U.S. to Exhibit German Export Goods.—An exhibition of German export products is to be held in New York during the autumn. Items are to be shipped free of charge, but firms wishing to take part have to submit their products to the Joint Import/Export Agency for selection, since exhibition space is limited to a total of 2000 sq.m.

Fertilisers from Refuse. — Berlin's refuse, which yields valuable nutritive salts, is now being used to improve the sand-soil in the Grunewald and Jungfernheide districts. Slime obtained from the nearby Havel-Lakes and containing 40 per cent lime, 28 per cent humus components and more phosphates than horse-manure, is used for the same purpose.

Oil Refinery Protest to Soviet.—A protest has been sent by Lt.-Gen. Keyes, U.S. Commissioner in Austria, to the Soviet Commissioner, Gen. Kurasov, against the occupation by Soviet troops of the oil refinery at Lobau, owned jointly by the Anglo-Iranian Oil Co. and the Socony-Vacuum Oil Co., of New York.

German Specialists for Canada.—The first group of German scientists whose special skill will be made available to Canadian industry under a plan announced last autumn will be brought to Canada shortly. They are six scientists who, under terms of the order-in-council arranging for their entry, must possess specialised knowledge which will enable the establishment in Canada of a new industry or expansion of existing operations. Provision is also made for entry of "screened" research scientists and university professors.

Brazil Needs Soda Chemicals.—Because of curtailment of exports from the U.K. and the U.S.A., soda ash and caustic soda are the materials which Brazilian industries chiefly require at the moment. The soap, glass, textile and paper industries have been particularly affected, especially the soap and glass industries. Brazilian monthly requirements are approximately 3500 tons of caustic soda and 3000 tons of soda ash, but at present consumers are getting only about one-half of these amounts. The situation has led to speculation and extremely high prices for both materials.

Malayan Rubber. — Dealers' stocks of rubber in Malaya in June totalled 76,057 tons, of which 59,627 tons were Singapore rubber, states the Malayan Union Government in London. Port stocks represented a further 21,407 tons. Ocean shipments of sheet and crepe rubber in June totalled 60,870 tons, of which the U.S.A. received 39,347 tons, the U.K. 8156 tons and Canada 2833 tons.

Sweden and Austria to Resume Trade.— During the recent visit of an Austrian trade delegation to Stockholm the Swedish Minister of Commerce indicated that his country would welcome the resumption of old connections with Austria. Negotiations for the conclusion of a trade pact are believed to be impending. Austrian exports to Sweden formerly consisted of textiles and hats, metal alloys, magnesite bricks, machinery and instruments, while Swedish exports to Austria consisted of various ferrous alloys, tubes, ball-bearings and vacuum-cleaners.

U.S. Coal and Iron Ore.—According to a report from the U.S. Department of the Interior, ample coal and iron ore supplies, the foundation of U.S. industrial economy, are assured for "many decades." However, the United States has less than 25 years' supply of copper and petroleum. Due to war-time depletion of its mineral wealth, U.S. dependence on copper, zinc, lead, rutile, platinum and tantalum from foreign sources has increased substantially. Virtual self-sufficiency was assured for a long time in soft coal and lignite, anthracite, natural gas, magnesium, nitrates, phosphate rock, potash, salt and sulphur. Complete or virtual dependence on foreign sources with a possible expectation of improving the position through new discoveries can be said of chromite, ferro-grade manganese, nickel, platinum metals, tin, industrial diamonds, quartz crystal, and spinning quality asbestos. An improved position through new discoveries is expected on cobalt and flake graphite.

Commercial Intelligence

The following are taken from printed reports, but we cannot be responsible for errors that may occur.

Increase of Capital

The nominal capital of **Norman Evans and Rais, Ltd.**, colour and chemical manufacturers, Manchester, 16, has been increased by £50,000, in 40,000 6 per cent redeemable first cumulative preference, 5000 7 per cent redeemable second cumulative preference and 5000 ordinary shares of £1, beyond the registered capital of £20,000. The capital now, therefore, consists of £40,000 6 per cent first preference, £15,000 second preference and £15,000 ordinary shares.

Company News

Sheffield Steel Products, Ltd., has reported a net profit for the year just ended of £90,157. A dividend of 15 per cent (less tax) is recommended.

Anchor Chemical Co. is to raise its ordinary interim dividend for the year ending November 30, 1947, by 3¾ per cent to 13¾ per cent. Warrants were posted yesterday.

Boots Pure Drug Company, Limited, have declared an interim dividend for the half-year ending September, 1947, of 10 per cent., less tax, to be paid on that date to ordinary shareholders on record on September 8, 1947.

British Glues and Chemicals, Ltd. announces a net profit of £217,827 for the year ended April 30, 1947. A final dividend of 20 per cent is proposed on the ordinary stock, which together with the interim dividend of 5 per cent paid on February 28 last, gives a total of 25 per cent for the year. The preferential stock receives 2 per cent, making in all (with the fixed cumulative dividend) 10 per cent.

New Companies Registered

Chemical Spraying Contractors, Ltd. (25,591). — Private company. Capital £10,000 in £1 shares. Directors: A. M. Bowen; G. C. Taylor; G. S. Chisholm and T. Raines. Registered office: 12 St. Andrew Square, Edinburgh.

Merk & Co. (Great Britain) Ltd. (440,168). Private company. Capital £100. To carry on the business of manufacturers of and dealers in chemicals, drugs, spirits, oils, herbs, roots, etc. Directors: Donald C. Tewson and Francis C. Howard. Registered office: 18 Austin Friars, E.C.2.

South Coast Insecticides, Ltd. (439,826). —Private company. Capital £1000 in £2 shares. Destroyers and exterminators of vermin of all kinds, etc. Directors: F. C. Eldridge; A. E. Whitford and R. F. Eldridge. Registered office: 54a Wycliffe Road, Winton, Bournemouth.

John D. Deas & Company, Ltd. (25,647). Private company. Capital £30,000 in £1 shares. To acquire the business now carried on as "John D. Deas & Co." at 84 Cathedral Street, Glasgow, and to carry on the business of manufacturers of oil, soap, disinfectants, etc. Directors: John D. Deas and J. G. Deas. Registered office: 84 Cathedral Street, Glasgow.

Research Chemists (Farnham), Ltd. (439,746). — Private company. Capital £1000 in £1 shares. Manufacturing chemists and druggists, etc. Directors: P. E. Leapman and Phyllis G. Leapman. Registered office: 25 The Borough, Farnham, Surrey.

Aldos Products (Philjoy) Ltd. (440,282). Private company. Capital £2000. To carry on the business of manufacturers of and dealers in cosmetics, oils, shampoos, hairdressing accessories, etc. Directors: T. D. Vezza and D. St. Q. Cottage. Registered office: 7 High Street South, E.6.

M. Faitelson, Ltd. (440,233). Private company. Capital £600. To carry on the business of manufacturers of and dealers in powders, dyes, soaps, salves, balms, compounds, ointments, lotions, creams and perfumes, and as hairdressers, sundriesmen, chemists and druggists, etc. Directors: Miss Sarah Faitelson, Israel R. Faitelson and Matthias Faitelson. Registered office: 10 Gravel Lane, Middlesex Street, E.C.

Ernest Newton and Co., Ltd. (439,778).— Private company. Capital £50,000 in 20,000 5 per cent redeemable cumulative preference, 20,000 ordinary and 10,000 founders shares of £1. To acquire the business of manufacturing chemists, drysalters and oil dealers carried on by H. Newton as "Ernest Newton and Co." at 15-16 Holt Street, Birmingham. Directors: H. Newton and E. J. Newton. Solicitors: Pinsent and Co., Birmingham.

Chemical and Allied Stocks and Shares

WITH business in stock markets down to its lowest level for two years, small irregular movements have ruled in most sections, fears that increased inflation may result from the Government's crisis plans and talk of fresh political developments being dominating factors. British Funds eased on the failure of the Leicester Corporation conversion offer—92 per cent has to be taken up by the National Debt Commissioners. Industrial shares lost part of an earlier rally, and iron and steels which had earlier showed all round improvement on "no nationalisation" hopes, later eased on the view that despite the economic crisis the Government has decided on nationalisation of this vital industry in due course. As was to be expected buyers concentrated mainly on shares in essential and export industries. In this connection, chemical and kindred shares received more attention, although price movements were small and irregular in accordance with the surrounding tendency of stock markets.

Imperial Chemical at 45s. 6d. lost part of an earlier rally and now yield over 4⅜ per cent on the basis of last year's 10 per cent distribution. Monsanto Chemicals 5s. ordinary were 55s. The market is assuming that in due course Imperial Chemical £1 units are likely to be "split" into four of 5s. each. B. Laporte were 92s. 6d., and W. J. Bush 90s., while Fisons have been dealt in up to 61s. 3d., and awaiting the final dividend and consolidated accounts, the units of the Distillers Co. have changed hands around 142s. United Molasses after 52s. eased to 51s. 6d. British Plaster Board were 27s. 3d., and Associated Cement 70s. 9d. British Glues & Chemicals 4s. ordinary strengthened to 20s., and in other directions, Lever & Unilever were better at 53s. 1½d., while Imperial Smelting firmed up to 20s., and Amalgamated Metal to 18s.

There was increased business in textile shares in response to the big export plans and Calico Printers ordinary improved to 21s. 9d. on hopes that dividends may shortly be resumed. Bradford Dyers were 22s. Fine Spinners improved to 29s. 6d., and Bleachers to 11s. 4½d.

Earlier gains in iron and steels which were due partly to the industry's increased output target were partly lost on the assumption that the Government is planning nationalisation, despite the economic crisis. Guest Keen at 43s. showed firmness in response to the good impression created by the report and accounts. United Steel were 25s. 4½d., Stewarts & Lloyds receded to 51s. 7½d., Dorman Long were 27s. (after 27s. 6d.) but at the time of writing, heavy engineering and allied shares have remained firm on the assumption that in any case they are outside the nationalisation threat. Babcock & Wilcox held their rally to 68s. 10½d. and helped by the company's tractor and kindred interests, Ruston & Hornsby were favoured up to 63s.

Although the market is doubtful if financial results for the year ended June 30 will show any striking recovery. Triplex Glass 10s. units rallied to 32s. 3d. having moved with motor shares which were favoured on hopes of big expansion in export trade. In other directions, General Refractories firmed up to 23s., and colliery shares were favoured on the view that in many cases higher prices than those now current will be justified by the nationalisation compensation terms. Home rails were prominent because they have the protection of the "take-over" prices which it is assumed will be reached by market prices before the exchange into British Transport stock. Boots Drug have been relatively steady at 58s. 9d., Sangers were 36s., and British Drug Houses 13s. 3d., while Glaxo Laboratories firmed up to £22⅜. Oil shares were less active but steadier. Anglo-Iranian improved to £9¾ but later changed hands down to £9½.

Prices of British Chemical Products

THE general chemical market is without feature this week, conditions remaining unchanged and comparatively quiet. New business has been of small dimensions due to seasonal influences and delivery specifications against existing contracts have been similarly affected. No important price changes have been reported either for industrial chemicals or coal-tar products. The demand in the last-mentioned market continues to be in excess of supplies.

MANCHESTER.—In the Manchester chemical market as a whole, quotations of the alkalis and other heavy products during the past week have continued on a very firm basis, though little in the way of actual movement has been reported. New business has been of rather bigger volume than was recorded in the previous week, but holiday influences are still in evidence and are likely to be, though on a diminishing scale, during the next three or four weeks. Fresh buying has included orders on export account, although the tightness of supplies in a number of the soda products makes actual overseas shipments a matter of no little difficulty. A full absorption of offers characterises most sections of the tar products market.

GLASGOW.—In the Scottish chemical trade business has returned to near normal after the holidays. There has been a steady demand over the whole field of chemicals. The demand for zinc oxide appears to be on the increase and the supply position is deteriorating. Sodium sulphide is also in heavy demand and here again the supply position is bad. In the export market inquiries have increased. A number of valuable orders for chromium fluoride have been lost as export licences for this material are not obtainable. The demand for caustic soda, sodium sulphide and sodium carbonate, all of which are in poor supply, continues unabated. There has been an increased demand for ground limestone. It is noteworthy that in a few countries it is becoming easier to obtain import licences.

Price Changes

Rises: Sodium metasilicate, lead nitrate.
Decreases: Cream of tartar, copper sulphate.

General Chemicals

Acetic Acid.—Maximum prices per ton: 80% technical, 1 ton, £56 10s.; 80% pure, 1 ton, £58 10s.; commercial glacial 1 ton £70; delivered buyers' premises in returnable barrels: £4 10s. per ton extra if packed and delivered in glass.

Acetone.—Maximum prices per ton, 1/5 tons, £86 10s.; single drums, £87 10s.; delivered buyers' premises in returnable drums or other containers having a capacity of not less than 45 gallons each. For delivery in non-returnable containers of 40/50 gallons, the maximum prices are £3 per ton higher. Deliveries of less than 10 gallons free from price control.

Alum.—Loose lump, £16 per ton, f.o.r. MANCHESTER: £16 to £16 10s.

Aluminium Sulphate.—Ex works, £11 10s. per ton d/d. MANCHESTER: £11 10s.

Ammonia, Anhydrous.—1s. 9d. to 2s. 3d. per lb.

Ammonium Bicarbonate.—MANCHESTER: £40 per ton d/d.

Ammonium Carbonate.—£42 per ton d/d in 5 cwt. casks. MANCHESTER: Powder, £43 d/d.

Ammonium Chloride.—Grey galvanising, £22 10s. per ton, in casks, ex wharf. Fine white 98%, £21 to £25 per ton. See also Salammoniac.

Ammonium Persulphate.—MANCHESTER: £5 per cwt. d/d.

Antimony Oxide.—£162 10s. per ton.

Arsenic.—Per ton, 99/100%, £38 6s. 3d. to £41 6s. 3d., according to quality, ex-store.

Barium Carbonate.—Precip., 4-ton lots, £20 per ton d/d; 2-ton lots, £20 5s. per ton. bag packing, ex works.

Barium Chloride.—98/100% prime white crystals, 4-ton lots, £19 10s. per ton, bag packing, ex works.

Barium Sulphate (Dry Blanc Fixe).—Precip., 4-ton lots, £20 per ton d/d; 2-ton lots, £20 5s. per ton.

Bleaching Powder.—Spot, 35/37%, £11 to £11 10s. per ton in casks, special terms for contract.

Borax.—Per ton for ton lots, in free 1-cwt. bags, carriage paid: Commercial, granulated, £30; crystals, £31; powdered, £31 10s.; extra fine powder, £32 10s. B.P., crystals, £39; powdered, £39 10s.; extra fine, £40 10s. Borax glass, per ton in free 1-cwt. waterproof paper-lined bags, for home trade only, carriage paid: lump, £77; powdered, £78.

Boric Acid.—Per ton for ton lots in free 1-cwt. bags, carriage paid: Commercial, granulated, £52; crystals, £53; pow-

dered, £54; extra fine powder, £56. B.P., crystals, £61; powder, £62; extra fine, £64.

Calcium Bisulphide.—£6 10s. to £7 10s. per ton f.o.r. London.

Calcium Chloride.—70/72% solid, £5 15s. per ton, ex store.

Charcoal, Lump.—£25 per ton, ex wharf. Granulated, £30 per ton.

Chlorine, Liquid.—£23 per ton, d/d in 16/17 cwt. drums (3-drum lots).

Chrometan.—Crystals, 5½d. per lb.

Chromic Acid.—1s. 10d. to 1s. 11d. per lb., less 2½%, d/d U.K.

Citric Acid.—Controlled prices per lb., d/d buyers' premises. For 5 cwt. or over, anhydrous, 1s. 6¾d., other, 1s. 5d.; 1 to 5 cwt., anhydrous, 1s. 9d., other, 1s. 7d. Higher prices for smaller quantities.

Copper Carbonate.—MANCHESTER: 1s. 7d. per lb.

Copper Oxide.—Black, powdered, about 1s. 4½d. per lb.

Copper Sulphate.—£44 12s. 6d. per ton f.o.b., less 2%, in 2 cwt. bags.

Cream of Tartar.—100 per cent., per cwt., from 201s. to 205s. per cwt. lots, d/d.

Formaldehyde.—£27 to £28 10s. per ton in casks, according to quantity, d/d. MANCHESTER: £28.

Formic Acid.—85%, £54 per ton for ton lots, carriage paid.

Glycerine.—Chemically pure, double distilled 1260 s.g., £6 per cwt. Refined pale straw industrial, 5s. per cwt. less than chemically pure.

Hexamine.—Technical grade for commercial purposes, about 1s. 4d. per lb.; free-running crystals are quoted at 2s. 1d. to 2s. 3d. per lb.; carriage paid for bulk lots.

Hydrochloric Acid.—Spot, 7s. 6d. to 8s. 9d. per carboy d/d, according to purity, strength and locality.

Hydrofluoric Acid.—59/60%, about 1s. to 1s. 2d. per lb.

Hydrogen Peroxide.—11d. per lb. d/d, carboys extra and returnable.

Iodine.—Resublimed B.P., 10s. 4d. to 14s. 6d. per lb., according to quantity.

Lactic Acid.—Pale tech., £70 per ton; dark tech., £60 per ton ex works; barrels returnable.

Lead Acetate.—White, 95s. to 100s. per cwt., according to quantity.

Lead Nitrate.—About £95 per ton d/d in casks. MANCHESTER: £115.

Lead, Red.—Basic prices per ton: Genuine dry red lead, £106; orange lead, £118. Ground in oil; Red, £132; orange £144. Ready-mixed lead paint: Red, £140; orange, £152.

Lead, White.—Dry English, in 8-cwt. casks, £116 10s. per ton Ground in oil, English, in 5-cwt. casks, £141 per ton.

Litharge.—£83 10s. to £86 per ton, according to quantity.

Lithium Carbonate.—7s. 9d. per lb. net.

Magnesite.—Calcined, in bags, ex works, £36 per ton.

Magnesium Chloride.—Solid (ex wharf), £27 10s. per ton.

Magnesium Sulphate.—£12 to £14 per ton.

Mercuric Chloride.—Per lb., for 2-cwt lots, 7s. 6d.; smaller quantities dearer.

Mercurous Chloride.—9s. per lb., according to quantity.

Mercury Sulphide, Red.—Per lb., from 10s. 3d. for ton lots and over to 10s. 7d. for lots of 7 to under 30 lb.

Methylated Spirit.—Industrial 66° O.P. 100 gals., 4s. 4d. per gal.; pyridinised 64° O.P. 100 gals., 4s. 5d. per gal.

Nitric Acid.—£24 to £26 per ton, ex works.

Oxalic Acid.—£100 to £105 per ton in ton lots packed in free 5-cwt. casks. MANCHESTER: £5 to £5 5s. per cwt.

Paraffin Wax.—Nominal.

Phosphorus.—Red, 3s. per lb. d/d; yellow, 1s. 10d. per lb. d/d.

Potash, Caustic.—Solid, £65 10s. per ton for 1-ton lots; flake, £76 per ton for 1-ton lots. Liquid, d/d, nominal.

Potassium Bichromate.—Crystals and granular, 9¾d. per lb.; ground, 10¾d. per lb., for not less than 6 cwt.; 1-cwt. lots, ½d. per lb. extra.

Potassium Carbonate.—Calcined, 98/100%, £57 10s. per ton for 5-ton lots, £57 10s. per ton for 1 to 5-ton lots, all ex store; hydrated, £51 10s. per ton for 5-ton lots, £51 10s. for 1 to 5-ton lots.

Potassium Chlorate.—Imported powder and crystals, nominal.

Potassium Iodide.—B.P., 8s. 8d. to 12s. per lb., according to quantity.

Potassium Nitrate.—Small granular crystals, 76s. per cwt. ex store, according to quantity.

Potassium Permanganate.—B.P., 1s. 8½d. per lb. for 1-cwt. lots; for 3 cwt. and upwards, 1s. 8d. per lb.; technical, £7 14s. 3d. to £8 6s. 3d. per cwt., according to quantity d/d.

Potassium Prussiate.—Yellow, nominal.

Salammoniac.—First lump, spot, £48 per ton; dog-tooth crystals, £50 per ton; medium, £48 10s. per ton; fine white crystals, £21 to £25 per ton, in casks, ex store.

Salicylic Acid.—MANCHESTER: 2s. 1d. to 3s. 0d. per lb. d/d.

Soda, Caustic. — Solid 76/77%; spot, £18 4s. per ton d/d.

Sodium Acetate.—£42 per ton, ex wharf.

Sodium Bicarbonate.—Refined, spot, £11 per ton, in bags.

Sodium Bichromate.—Crystals, cake and powder, 8d. per lb.; anhydrous, 7½d. per lb., net, d/d U.K. in 7-8 cwt. casks.

Sodium Bisulphite. — Powder, 60/62%, £19 10s. per ton d/d in 2-ton lots for home trade.

Sodium Carbonate Monohydrate.—£25 per ton d/d in minimum ton lots in 2 cwt. free bags.

Sodium Chlorate.—£45 to £47 per ton.

Sodium Hyposulphite.—Pea crystals 22s. 6d. per cwt. (2 ton lots); commercial, 1-ton lots, £17 per ton carriage paid. Packing free.

Sodium Iodide.—B.P., for not less than 28 lb., 10s. 2d. per lb.

Sodium Metaphosphate (Calgon).—11d. per lb. d/d.

Sodium Metasilicate.—£18 per ton, d/d U.K. in ton lots.

Sodium Nitrite.—£23 per ton.

Sodium Percarbonate.—12½% available oxygen, £7 per cwt.

Sodium Phosphate.—Di-sodium, £30 10s. per ton d/d for ton lots. Tri-sodium, £35 per ton d/d for ton lots (crystalline).

Sodium Prussiate.—9d. to 9½d. per lb. ex store.

Sodium Silicate.—£6 to £11 per ton.

Sodium Sulphate (Glauber Salt).—£7 17s. 6d. per ton d/d.

Sodium Sulphate (Salt Cake).—Unground. Spot £4 11s. per ton d/d station in bulk. MANCHESTER: £4 12s. 6d. to £4 15s. per ton d/d station.

Sodium Sulphide. — Solid, 60/62%, spot, £20 12s. 6d. per ton, d/d, in drums; crystals, 30/32%, £13 12s. 6d. per ton, d/d, in casks.

Sodium Sulphite.—Anhydrous, £29 10s. per ton; pea crystals, £20 10s. per ton d/d station in kegs; commercial, £12 to £14 per ton d/d station in bags.

Sulphur.—Per ton for 4 tons or more, ground, £14 12s. 6d. to £16 17s. 6d., according to fineness.

Sulphuric Acid.—168° Tw., £6 2s. 8d. to £7 2s. 8d. per ton; 140° Tw., arsenic-free, £4 15s. per ton;; 140° Tw., arsenious, £4 7s. 6d. per ton. Quotations naked at sellers' works.

Tartaric Acid.—Per cwt., for 10 cwt. or more, £15 8s.; 5 to 10 cwt., £15 9s. 6d.; 2 to 5 cwt., £15 11s.; 1 to 2 cwt., £15 13s. Less than 1 cwt., 3s. 1d. to 3s. 3d. per lb. d/d, according to quantity.

Tin Oxide.—1 cwt. lots d/d £25 10s.

Zinc Oxide.—Maximum prices per ton for 2-ton lots, d/d; white seal, £68 15s.; green seal, £70 5s.; red seal, £71 5s.

Zinc Sulphate.—No quotation.

Rubber Chemicals

Antimony Sulphide.—Golden, 3s. to 4s. per lb. Crimson, 2s. 7½d. to 3s. per lb.

Arsenic Sulphide.—Yellow, 1s. 9d. per lb.

Barytes.—Best white bleached, £8 8s. 6d. per ton.

Cadmium Sulphide.—6s. to 6s. 6d. per lb.

Carbon Bisulphide.—£37 to £41 per ton, according to quality, in free returnable drums.

Carbon Black.—6d. to 8d. per lb., according to packing.

Carbon Tetrachloride.—£48 to £51 per ton, according to quantity.

Chromium Oxide.—Green, 2s. per lb.

India-rubber Substitutes.—White, 10 5/16d to 1s. 5½d. per lb.; dark, 10½d. to 1s. per lb.

Lithopone.—30%, £32 17s. 6d. per ton.

Mineral Black.—£7 10s. to £10 per ton.

Mineral Rubber, "Rupron."—£20 per ton.

Sulphur Chloride.—7d. per lb.

Vegetable Lamp Black.—£49 per ton.

Vermilion.—Pale or deep, 15s. 6d. per lb. for 7-lb. lots.

Nitrogen Fertilisers

Ammonium Phosphate.—Imported material, 11% nitrogen, 48% phosphoric acid, per ton in 6-ton lots, d/d farmer's nearest station, in December £20 4s. 6d., rising by 2s. 6d. per ton per month to March, 1947.

Ammonium Sulphate.—Per ton in 6-ton lots, d/d farmer's nearest station, in December £9 18s. 6d., rising by 1s. 6d., per ton per month to March, 1947.

Calcium Cyanamide.—Nominal; supplies very scanty.

Concentrated Fertilisers.—Per ton d/d farmer's nearest station, I.C.I. No. 1 grade, where available, £14 18s. 6d.

"Nitro Chalk."—£9 14s. per ton in 6-ton lots, d/d farmer's nearest station.

Sodium Nitrate.—Chilean super-refined for 6-ton lots d/d nearest station, £17 5s. per ton; granulated, over 98%, £16 per ton.

Coal Tar Products

Benzol.—Per gal. ex works: 90's, 2s. 6d.; pure, 2s. 8½d.; nitration grade, 2s. 10½d.

Carbolic Acid.—Crystals, 11½d. per lb. Crude, 60's, 4s. 3d. MANCHESTER: Crystals, 9½d. to 11½d. per lb., d/d; crude, 4s. 3d., naked, at works.

Creosote.—Home trade, 6½d. to 9¾d. per gal., according to quality, f.o.r. maker's works. MANCHESTER, 6½d. to 9¾d. per gal.

Cresylic Acid.—Pale, 97%, 3s. 6d. per gal.; 99%, 4s. 2d.; 99.5/100%, 4s. 4d. American, duty free, 4s. 2d., naked at works. MANCHESTER: Pale, 99/100%, 4s. 4d. per gal.

Naphtha.—Solvent, 90/160°, 2s. 10d. per gal. for 1000-gal. lots; heavy, 90/190°, 2s. 4d. per gal. for 1000-gal. lots. d/d Drums extra; higher prices for smaller lots. Controlled prices.

Naphthalene.—Crude, ton lots, in sellers' bags, £8 1s. to £12 13s. per ton according to m.p.; hot-pressed, £14 15s. to £15 14s. per ton, in bulk ex works; purified crystals, £28 to £43 5s. per ton. Controlled prices.

Pitch.—Medium, soft, home trade, 75s. to 80s. per ton f.o.r. suppliers' works; export trade, £6 15s. per ton f.o.b. suppliers' port. MANCHESTER: 77s. 6d. f.o.r.

Pyridine.—90/140°, 18s. per gal.; 90/160°, 14s. MANCHESTER: 14s. 6d. to 18s. 6d. per gal.

Toluol.—Pure, 3s. 2½d. per gal.; 90's, 2s. 4d. per gal. MANCHESTER: Pure, 3s. 2½d. per gal. naked.

Xylol.—For 1000-gal. lots, 3s. 3½d. to 3s. 6d. per gal., according to grade, d/d.

Wood Distillation Products

Calcium Acetate.—Brown, £15 per ton; grey, £22.

Methyl Acetone.—40/50%, £56 to £60 per ton.

Wood Creosote.—Unrefined, from 3s. 6d. per gal., according to boiling range.

Wood Naphtha.—Miscible, 4s. 6d. to 5s. 6d. per gal.; solvent, 5s. 6d. to 6s. 6d. per gal.

Wood Tar.—£6 to £10 per ton.

Intermediates and Dyes (Prices Nominal)

m-**Cresol** 98/100%.—Nominal.

o-**Cresol** 30/31° C.—Nominal.

p-**Cresol** 34/35° C.—Nominal.

Dichloraniline.—2s. 8½d. per lb.

Dinitrobenzene.—8½d. per lb.

Dinitrotoluene.—48/50° C., 9½d. per lb; 66/68° C., 1s.

p-**Nitraniline.**—2s. 5d. per lb.

Nitrobenzene.—Spot, 5½d. per lb. in 90-gal drums, drums extra, 1-ton lots d/d buyer's works.

Nitronaphthalene.—1s. 2d. per lb.; P.G., 1s. 0½d. per lb.

o-**Toluidine.**—1s. per lb., in 8/10 cwt. drums, drums extra.

p-**Toluidine.**—2s. 2d. per lb., in casks.

m-**Xylidine Acetate.**—4s. 5d. per lb., 100%.

Latest Oil Prices

LONDON.—August 15. For the period ending August 31 (September 13, 1947, for refined oils), per ton, naked, ex mill, works or refinery, and subject to additional charges according to package; LINSEED OIL, crude, £200. RAPESEED OIL, crude, £190. COTTONSEED OIL, crude, £109; washed, £112. COCONUT OIL, crude, £106; refined deodorised, £112; refined hardened deodorised, £116. PALM KERNEL OIL, crude, £105 10s., refined deodorised, £112; refined hardened deodorised, £116. PALM OIL (per ton c.i.f.), in returnable casks, £99 5s.; in drums on loan, £98 15s., in bulk, £97 15s. GROUNDNUT OIL, crude, £110 10s.; refined deodorised, £114, refined hardened deodorised, £118. WHALE OIL, refined hardened, 42 deg., £117; refined hardened, 46/48 deg., £118. ACID OILS, Groundnut, £94; soya, £92; coconut and palm-kernel, £97 10s. ROSIN: Wood, 32s. to 45s.; gum, 44s. to 54s. per cwt., ex store, according to grade. TURPENTINE, American, 87s. per cwt. in drums or barrels, as imported (controlled price).

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Pine Gums

Experimental Work in Italy

FIVE experimental factories in Italy are engaged in studying the possibility of extracting colophony from the local pines. About half a million trees are available for this purpose and it is calculated that they could give a yearly output of 400 tons of resin from which at least 160 tons of colophony and turpentine could be extracted. As Italy is dependent practically entirely on the supplies of colophony from abroad this experiment is of great interest. There are good reasons to expect that a more rational exploitation of the trees and improvements in processing would yield even better results.

A Too-Mechanical Age

"This is a mechanical age and I am the last to decry the value, indeed the necessity, of utilising machinery to the full, but I think that the machine has been allowed to oust the more important factors in life—the spiritual factors—and that we have to go back to these essentials if we are to win through and bring this country back to the proud position which it has held so long."—Mr. Kenneth M. Chance, chairman and managing director of British Industrial Plastics, Ltd., speaking at the annual meeting.

Opencast Coal Plans

Because of the great need of maximum coal production, the Government has decided to extend the current programme of opencast coal mining until 1951. The programme was planned to end in 1949. The decision is intended to enable contractors to carry out the development schemes they have in hand to raise output above the present level of 9-10 million tons annually and to bring into use the machinery which has been ordered in the U.S.A. Opencast mining, since its start in 1942, has produced 36 million tons of coal and now represents about 5 per cent of total British coal production.

Olympia Exhibition

Saunders Valve Co., Ltd., of Newport, Mon., advises that it will be showing a range of six "Safran" centrifugal pumps at the Engineering and Marine Exhibition to be held at Olympia from August 28 to September 13. Among other exhibits there will be a wide range of standard diaphragm valves including the air-motor operated valve and the self-closing valve. The company's glandless diaphragm plug cock for aircraft will also be on view.

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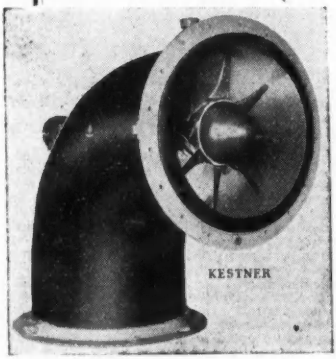

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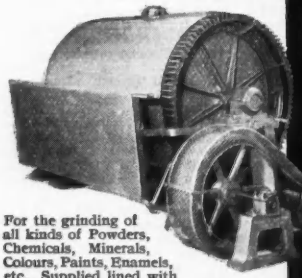

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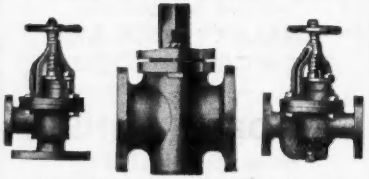

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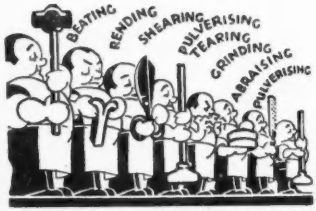

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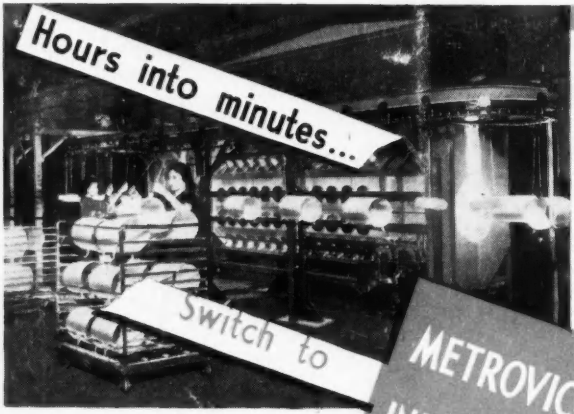

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